Magnetic - inductive flowmeter type PEM-1000

USER'S MANUAL

PEM-1000ALW

PEM-1000NW

- Flexible and clever assembling system
- Easy and fast-moving change from compact to remote version
- Innovative and high-power transmitter for every aplication
- Robust and resistant cover of sensor and transmitter

Applications

- Water treatment
- Chemical, food, pharmaceutical industry
- Power, civil engineering
- Agriculture

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NOTE:
Because every product is subjected to a development, it can happen that during a period some changes may appear which are not included in the User Guide. Possible differences from the description in this Guide can be found by pressing keys on the keyboard in menu. All unclear items should be directly consulted in factory.

Aplisens JSC . 2009

Contents:

	page
Introduction	1
Specifications	2
Technical data – sensor and control unit	6
Technical data – control unit terminal board	7
Dimensions, possibilities of assembly	8
Instructions for use	12
Instructions for adjustment	16
Example of Smart unit adjustment	23

Introduction:

PEM-1000 magnetic-inductive flowmeters are precise measuring devices intended for the measurement of liquid flow of electrically conductive media. The meters may be used for measurements, registration, dosing, mixing, etc. as operating and/or certificated meters according to Act no. 505/1990 Coll. on Metrology.

PEM-1000 application

- Water management, drinking and waste water measurement
- Chemical, textile, paper, mining industry
- Food industry
- Power engineering and heating plants
- Agriculture

PEM-1000 advantages

- Independent of power supply fluctuation and line voltage interference
- Independent of pressure, temperature and density, etc of the media
- No pressure losses
- No disturbances of measured liquid consistency

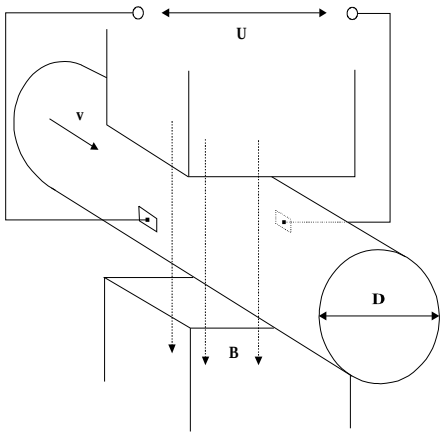
Do not install where

- Liquid conductivity is below 5 μS/cm (20 μS/cm for demineralized water)
- Partly filled pipe is possible
- Non lamina flow occurs
- Liquid velocity can be less than 0.3 m/sec

The principle of inductive sensor operation

The measurement is based on the principle of Faraday's law of electromagnetic induction. In compliance with this law, electric voltage is induced in an electrically conductive body, which moves across a magnetic field. The following equation is applied for voltage to be induced (generally):

$U = B \times D \times v$ where: U = inductive voltage D = piping diameter
v = mean flow speed vector B = magnetic induction



If magnetic induction B and piping diameter D are constant, then induction voltage is proportional to the mean flow speed.Liquid is flowing via a flowmeter perpendicularly to the direction of the magnetic field. Electric voltage which is monitored by two electrodes placed perpendicularly to both magnetic field and flow is induced by a stream of liquid with minimum electrical conductivity. Excitation current with a rectangular waveform is generated in a converter and fed to sensor coil windings generating the flowmeter magnetic field. The forced-current system provides constant excitation under all conditions that can occur during the operation.

Specifications:

Measurement conditions

Measurement is independent up on

- Liquid temperature and pressure
- Liquid density and viscosity
- Solids contents
- Usual level of magnetic field interference

For maintaining the PEM-1000 accuracy and reliability, it is necessary to meet the following conditions

- Minimum liquid conductivity >20 μs / cm for demineralized cold water.
  >5 μs / cm for other liquid.
- Liquid velocity min. 0.3 m / sec, max. 12 m / sec.
- Steady flow section performance no DN change bevel pipe part(s) of maximum 8^{o}
- Steady flow section length 5 DN upstream / 3 DN downstream (from sensor)
- Fully filled sensor profile with liquid measured.
- High quality operational contact between the sensor and liquid measured.

Measurement accuracy is interfered by

- Gassing of measured liquid and air bubbles
- Strong stray earth currents
- Liquid turbulence in the sensor
- Solids of magnetic metals in the medium measured

PEM-1000 options

Sensor option

- A measuring pipe is made of non-magnetic material with welded flanges and assembly clamps. An insulating liner with required properties is installed inside the pipe (according to the medium used). A system of driving coils generating the required magnetic field is directly fixed on the measuring pipe body.
- A pair of electrodes located opposite and passing through the measuring pipe with liner is made of high-grade steel and/or other material (according to the required chemical resistance against the medium being measured).
- The complete electrical section is assembled in steel housing (welded) with a neck for internal cabling.
- Remote version: A signal cable with the standard length of 8 m/ Cu type 2x2x0.25 mm^2 is attached to the neck and the cable passes through a cable seal (also other lengths are available).
- Compact version: The instrument box body is attached to the neck.
- The housing welding makes it possible to achieve a high-grade protection and surface finish provides a steady climate resistance.

Converter option

- Control and evaluation electronics is assembled into robust aluminium housing with a sight hole for the display, or in case of the blind version IP 67 protection is used.

Additional options

- PEM-1000 flowmeter as „working/certificated meter“ complies with the Act on Metrology no. 505/1990 Coll.Metrological properties according to the customer's requirements are determined by verification and identification with the official mark and these cannot be changed.
- Multi-point calibration of the measuring range. The flowmeters are usually calibrated in 3 points. On the customer‘s request, the number of calibration points can be increased.
- Higher sensor protection IP 68: the requirement must be precisely defined (i.e. immersion depth and time, and/or explosive zones).
- Higher PN, and/or different sensor built-in lengths, different flange options (DIN, ANSI, etc.), after consultation of your supply.
- Controlled data acquisition program – it allows evaluating the statistical readout data on a PC WIN.

PEM-1000 connection and assembly

Converter connection to power supply must be performed in compliance with the standards and rules to be effective

- If requested our Service Division will carry out commissioning. If work is done by any different organisation, the warranty can be cancelled in the case of such unauthorised work.
- Electrical protection allows the use of the instrument in all kinds of active, passive and complex environments, and after an agreement with us, it is possible to carry out some additional modifications even for severe climaticconditions.

- Signal and output cable routing should not be located near power output distribution network or in common ducts.

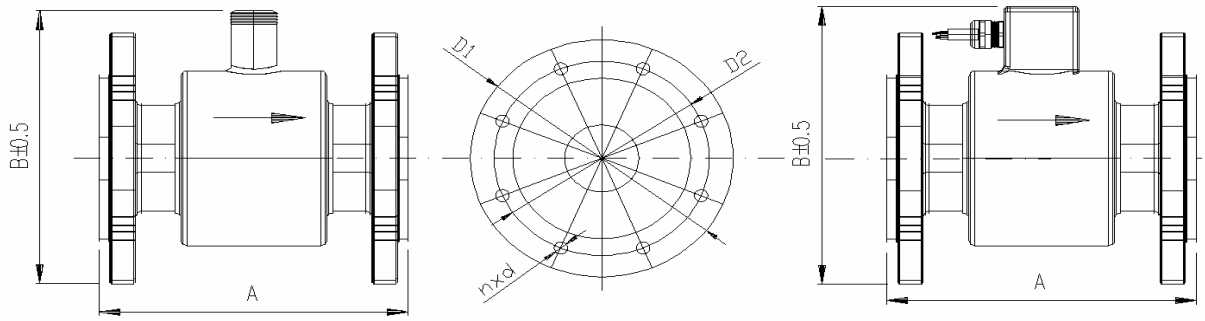
Table for 1 m / s flowrates

DN	m^3 / h	l / min.	l / s
10	0,283	4,712	0,079
15	0,637	10,62	0,177
20	1,131	18,85	0,314
25	1,767	29,452	0,491
32	2,895	48,255	0,804
40	4,524	75,398	1,257
50	7,069	117,81	1,964
65	11,946	199,1	3,318
80	18,096	301,59	5,027
100	28,274	471,23	7,854
125	44,179	736,31	12,272
150	63,617	1060,3	17,671
200	113,10	1885	31,42
250	176,71	2945,2	49,087
300	254,47	4241,2	70,686
350	346,36	5772,7	96,211
400	452,39	7539,8	125,66
450	572,26	9537,5	158,96
500	706,86	11781	196,35
600	1017,9	16965	282,74
700	1384,7	23079	384,65
800	1809,6	30159	502,65
900	2289,1	38151	635,85
1000	2827,4	47124	785,4

Constructional dimensions and weights of inductive sensors

		Dimensions [mm]						Weight
DN	PN	A	B	D1	D2	d	n	kg
10	16	150	153	90	60	14	4	2,5
15		or 200	155	95	65	14	4	2,5
20			160	105	75	14	4	3
25			167	115	85	14	4	3,5
32			180	140	100	18	4	5
40			185	150	110	18	4	6
50		200	191	165	125	18	4	7
65			209	185	145	18	4	8
80			224	200	160	18	8	9,5
100		250	245	220	180	18	8	12
125			276	250	210	18	8	15
150		300	305	285	240	22	8	20
200		350	375	340	295	22	12	36
250		400	430	405	355	26	12	58
300		500	487	460	410	26	12	70
350			542	520	470	26	16	85
400		600	615	580	525	30	16	100
450			657	640	585	30	20	120
500			750	715	650	33	20	160
600			870	840	770	36	20	190
700		700	927	910	840	36	24	260
800		800	1050	1025	950	39	24	350
900		900	1145	1125	1050	39	28	450
1000		1000	1285	1255	1170	42	28	550

Tolerance of built-in lengths:
DN 10 – DN 150 $\Rightarrow$ A ± 5 mm, DN 200 – DN 1000 $\Rightarrow$ A ± 10 mm



Signal cable connection

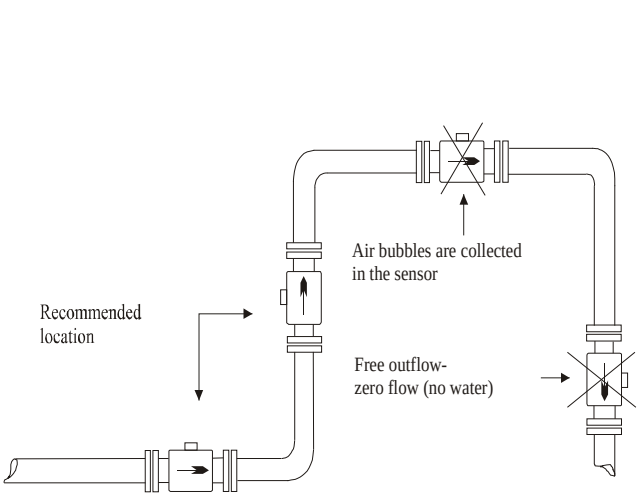
- Signals which are transmitted from a sensor electrode circuit to the converter will be in a range of millivolts. They will be very sensitive to magnetic and electrostatic interference from neighbouring high-voltage cables, power supply cables and high power output motors, etc. The interference is mainly compensated for by the converter connection, nevertheless if possible, it is necessary to prevent all spurious signals.
- The signal cable is of a special construction and length and is a part of the shipment, its length should not be changed (for certificated meter must not be changed). The proper cable connection to the converter is important; doing so may cause measurement failures. Special requirements are laid on shielding, and the measurement precisiondepends on its quality.
- The cable must not be extended.
- The shielding must be well insulated on the whole route from ground and the other metal subjects. It is recommended that the cable is located in a separate conduit or trays.

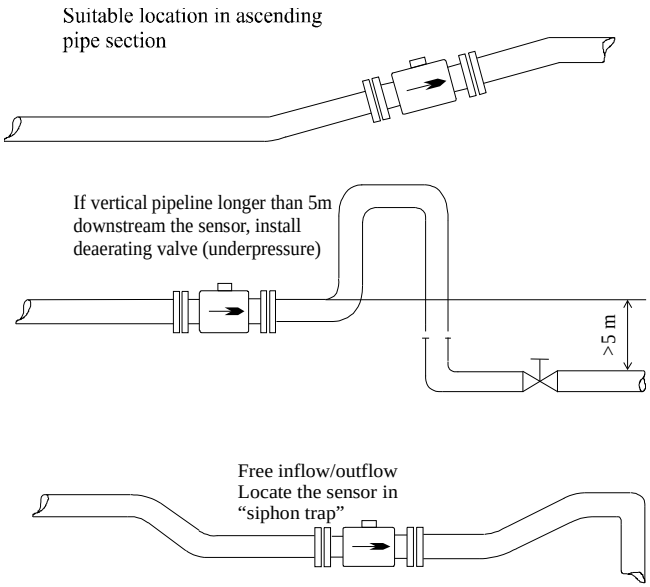
Sensor location and its position in piping

- The inductive flowmeter sensor can be installed in any position according to requirements, however for horizontal assembly, the electrode axis must always be horizontal.

- Sensor must remain full of liquid.
- It is recommended that the flow direction should follow the arrow on the sensor cover; the converter is also preset for this direction. On the operating meter, it is possible to adjust the reverse flow direction by changing the
- PEM-1000 cnverter parameter.
- Bolts and nuts – verify if there is a sufficient space for their installation near flanges.
- Vibration and deflection of piping – fix the piping on both sides from the flowmeter to avoid any deflection and vibrations.
- If you install any pipes with higher internal diameters, install a reducer; this will provide an axial shift without increased mechanical stress of piping and sensor flanges.
- To improve flow, use only the recommended straight lengths upstream (5DN) and downstream of the sensor (3DN). Any change of a diameter with an angle up to 8º is excluded from the above-mentioned straight lengths. Suitably assembled flow deflectors and a combination of diffusers are used in more sophisticated installations.
- When you install the sensor in insulated piping (e.g. glass, artificial mass, etc.), use proper sealing ground rings. A conductive connection between a sensor ground point and the liquid to be measured is needed for a proper measurement!

Recommended positions for sensor installation





To avoid any measurement errors which are caused by air bubbles or failures on the lining, pay attention to the following recommendations

- During assembling correctly seat the sensor, tighten screws uniformly and move on a diagonal one after another.
- It should be noted that the parallelism of flanges has a greater effect on packing than excessive tightening forces on curved and seated flanges.
- The sensor must be installed inside piping so that the axis of sensor electrode is always **horizontal.**
- A PTFE (teflon) lining calls for extra care during handling and assembly. During installation/operation avoid excessive underpressure in pipes. Please do not change and damage the outlet extension on both ends of the sensor. The sensors are shipped from the factory with special covers to avoid any shape deformations. (PTFE elastic memory should cause a partial compensation in future). Please remove the covers just before installation, and when you insert it between counterflanges, replace by a number of smooth metal sheet pieces which are removed just before tightening the bolts.
- Packing – The extended part of lining does not operate properly as a seal, hence appropriate packing must be inserted between sensor and pipeline. If the packing protrudes into a flow profile at any point, this will cause turbulence and reduce the measurement quality.
- During installation, make sure the sensor slides into piping if the pipeline is not flexible enough. It is recommended that installation inserts (especially for greater internal diameters) should be used. During installation of the sensor, counterflanges must not be welded (danger of the sensor lining failure).

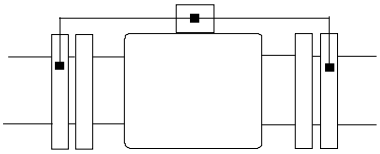
PEM-1000 grounding

- For reliable and proper operation of the inductive meter, it is necessary to use high-quality protective grounding. Internal flowmeter cables and power supply PE (PEN) conductors provide protective grounding. Working grounding is also provided via internal cables and a high-quality connection of the sensor body with two metal pipe counterflanges. It is recommended that a connection made with M6 welded screws or bored threaded holes is used. The connection under flange fixing screws is not recommended because of possible corrosion resulting in measurement failures.
  - When assembled into piping made from non-conductive material (or with non-conductive lining), it is necessary to provide working grounding with liquid by a different method, e.g. by grounding rings – valid for DN 10 ÷ DN 100. The rings can be ordered from factory, their material and chemical resistance must comply with the liquid to be measured – usually produced from the same material as sensor electrodes. The

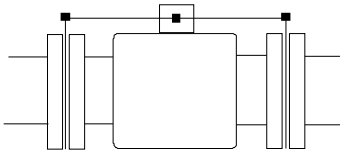
flowmeters from DN 50 ÷ DN 1000 are equipped of grounding electrode. Function of grounding electrode is same as grounding ring.

- When assembled, it is necessary to insert the packing on both sides of the grounding ring. Make sure that no parts will protrude into a internal sensor profile (turbulence).

Drawing of sensor working grounding inside pipeline



Use of grounding rings –valid for DN 10 ÷ DN 40



Electrodes

- The electrode material must be selected according to its chemical resistance of the liquid to be measured.
- The electrode purity can affect the measurement precision, and high impurity concentration can affect the measurement process (liquid insulation).
- Immediately after shipping, it is not necessary to clean the electrodes before installing the sensor inside piping. Clean with a fine cloth, or use a chemical detergent. Avoid any damage of the lining! If the electrodes must be cleaned during operation, either mechanical or electrolytic methods may be used. Mechanical cleaning can only be used for a suitable sensor assembly, otherwise dismantle the sensor from the pipeline. After cleaning reinstall the sensor.
- Any electrolytic method is advantageous for its simplicity, however it can only be applied for the contamination that can be removed by electrolysis (low contamination and deposit).
- All detailed instructions are available from the flowmeter manufacturer on request.
- If a flowmeter operates under normal conditions, for most liquids it is not necessary to clean flowmeters during their life, only self-cleaning by flowing liquid is satisfactory (a recommended velocity is over 3 m/s).

PEM-1000 commissioning

Checking installation and connections.

- Proper sensor and grounding
- Tightening all cable connection clamps and plug in all connectors.
- Verify the completeness of the shipped set according to the serial numbers of sensor and converter.
- Verify proper supply voltage; see the label on the converter.
- Verify proper electrical protection.
- If the installation is fault-free, fill the pipeline with liquid and verify the sensor tightness inside the pipeline. After short washout, switch the system on-off-on.

Additional devices

The additional devices are intended for remote control of the converter output signals (displaying and processing).

The additional devices are not usually included in PEM-1000 shipment, but their type should by approved by the manufacturer. In such a case, the manufacturer is only responsible for the suitability of input parameters, and all other parameters are set according to the manufacturer's specifications of the additional devices.

If PEM-1000 is used as a certificated meter, the additional devices that have passed a separate type test or have been included in the PEM-1000 type test can be used.

Packing, transportation and storage

If a set is ordered without installation, the sensor is packed in corrugated paper and the converter is enclosed in a cardboard box or wooden palette

Technical data

WARNING: The customer assume personal responsibility for reasonable using of sensor and unit.

Specification for magnetic-inductive sensor:

Nominal sizes	DN 10 ÷ 1000
Interconnecting cable	Compact version – standard 0,5 m / 2 x 2 x 0,25 mm^2 Remote version – standard 8 m / option 16, 24, 32, 40, 48 m
Control principle	Pulse DC
Excitation coils supply	From the transmitter
Excitation of coils isolation	Class E
Connection	Flanged DIN (ANSI, BS) / hygienic - food DIN 11 851
Maximum Pressure	Standard 1,6 MPa (0,6 / 1,0 / 2,5 / 4,0 MPa)
Protection	Standard IP 67 / NEMA 5 (IP 68 / NEMA 6)
Liner material	Hard + soft rubber DN 10 ÷ DN 1000 / Teflon PTFE DN 10 ÷ DN 500
Liner temperature	Hard + soft rubber -5°C ÷ +90°C / Teflon PTFE -25°C ÷ +130°C
Electrodes	Stainless steel 316Ti, L (Hastelloy / Tantalum / Titanium / Platinum)
Outer casing and flanges	Carbon steel standard (Stainless Steel 304, 321)
Flow tube	Stainless steel 321
External coating	Acrymetal multi component lacquer
Ambient temperature	-20°C ÷ +60°C
Accessories options	Stainless Steel Earthing rings for plastic pipe
Special Options	Stainless Steel version, food industry version

Specification for – PEM-1000 control unit:

Medium electrical conductivity	≥ 5 μS/cm, for demi water ≥ 20 μS/cm
Input resistance	≥ 10^{10} Ω
Measurement accuracy	0,3 % of reading, while flow is within 10 ÷ 100% of range; for reference conditions only *)
Flow filter	Multi-mode adjustment
Low flow rejection	Adjustable in steps of 0,1%
Flow direction	Bi-directional measurement distinguished by sing, current flow is summarized by total volume counters (S+ for possitive flow and S- for negative flow)
Zero flow	Automatic zero point setting
Empty pipe detection	With adjustable detection period
Data logger	4 months capacity; average 5-minute current flowrates, total volume and operating time by hour/day/month time slices
Real time	Clock and calendar including leap years until 2099; with battery backup
Display	LCD, alphanumeric, 2 x 16 characters, with backlight
Keyboard	4 keys
Analog output	**Active** galvanically separated, 0(4)÷20 mA / 500 Ω, 0÷5 mA / 2 kΩ or generally selected to maximum 30 mA / 300 Ω, *overvoltage protection of III. level*
Frequency output	0÷1 kHz / 0÷100 % from flow rate range, galvanically separated, **passive** - free optocoupler, external load 8,2 – 10 kΩ, voltage supply for external load max. 24VDC+10%
Binary outputs	1÷4 x relays, non-voltage contact, non-inductive load, 250VAC/3A, 30VDC/3A; **modes:** pulse (according to total flow in possitive and negative flow), comparing (4 submodes), status (air intake) – see *Instructions for use*
Communication output (must be specificated)	RS 485 (galvanically separated) or RS 232 C, company protocol ELA-2; for current and stored data transmission to PC, PLC etc. ; on request: software for data acquisition Smart MQI for Windows
Cable outlets	3x PG 11, power supply cable 3 x 1 – 1,5 mm^2 Cu
Power supply	85 ~ 260 VAC/50~60 Hz/10 VA ∧ 9 ~ 36 VDC/10 W ∧ 24 VDC/10 W (± 10 %)
Fuse	630 mA/F
Electric protection	IP 67 (NEMA 5)
Ambient temperature	-20º C ÷ +50ºC
Dimensions	180 x Ø 115 mm
Weight	2,6 kg
Housing material	Cast AlSi 10Mg / EN AC-47100
Surface finish	Powered coated (komaxit, anodizing)

*) Reference conditions (according to EN 29 104):

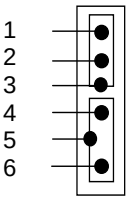
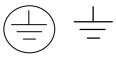
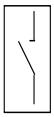
Measuring range	0,3 – 12 m/s
Measured medium	Water 10 – 30° C
Conductivity	> 300 μS/cm
Power supply	U_N ± 2% (U_N= voltage rating)
Ambient temperature	18 - 25º C, steady humidity
Stabilization min.	20 minutes
Steady flow section	10 x upsteam sensor, 3 x downstream sensor
Sensor	Fixed, centered and earthed properly

Technical data

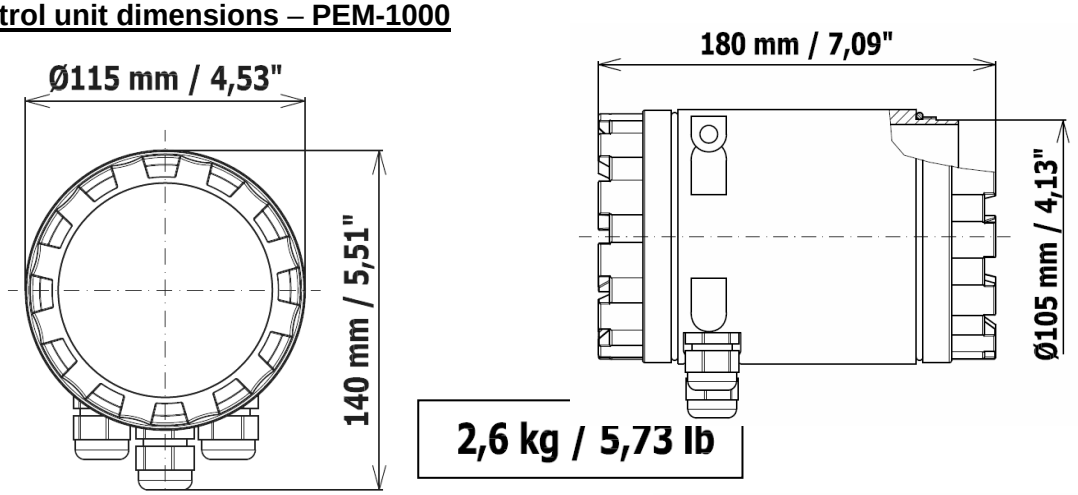
WARNING: For reason of safety and protection health of consumers is necessary to make equipment ground ! (Separate terminal PE on body of equipment.)

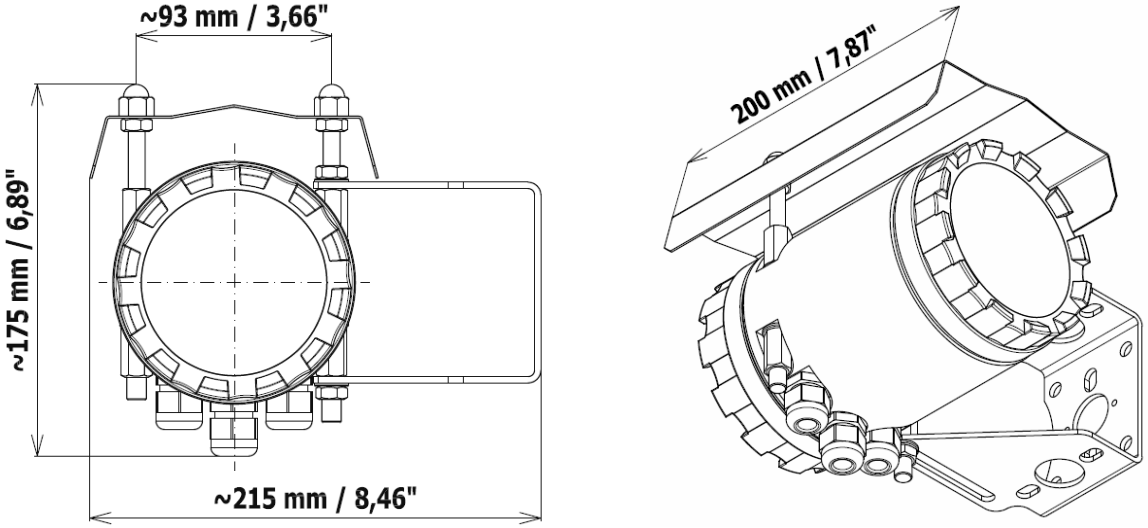
Control unit terminal board, input / output connection and basic functions:

SENSOR | COMMUNICATION | OUTPUTS | POWER SUPPLY | RELAYS | BOARD CONNECTION

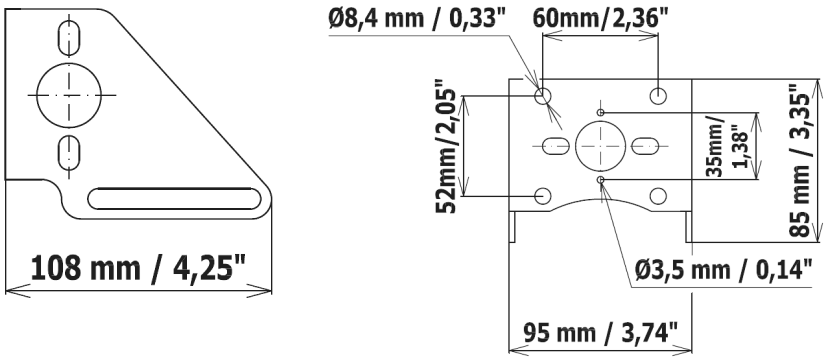
	STANDARD	**OPTION**	
1 2 3 4 5 6 	yellow field green field braiding function ground and screen E2 brown signal braiding screen E1 white signal compact version – cable lenght 0,5 m remote version – cable lenght 8 m	cable lenght for remote version 16, 24, 32, 40, 48 m	
7 8 9		RS 232 RxD TxD GND cable max. 10 m	RS 485 A B cable max. 500 m
10 11 12 13 14 15	analog output **active output** unwired contact unwired contact frequency output 0 ÷ 1 kHz **passive free optocoupler**		
16 17 L N PE 	**85 ~ 260 VAC/10VA** do not connect do not connect mains L mains N mains PE	9 ~ 36 VDC/10W do not connect do not connect + 9 ~ 36 V 0 V protective wire	24 VDC/10W + 24 V 0 V do not connect do not connect protective wire
21,22 31,32 41,42 51,52 	relay 1 / <250 VAC, <30 VDC/<3A totalizer, comparators, failure, etc.	relay 2 / <250 VAC, <30 VDC/<3A relay 3 / <250 VAC, <30 VDC/<3A relay 4 / <250 VAC, <30 VDC/<3A totalizer, comparators, failure, etc.	

Control unit dimensions – PEM-1000

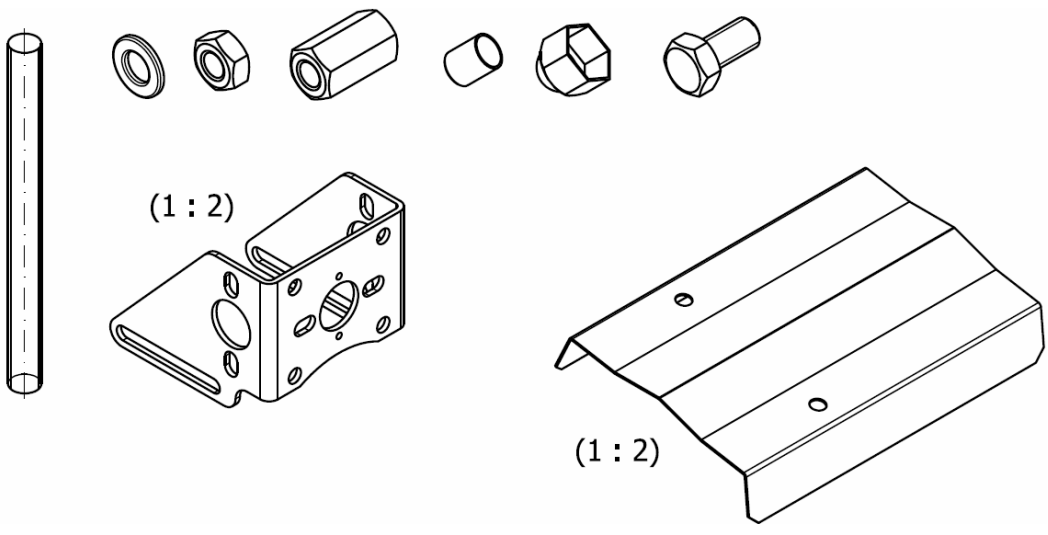




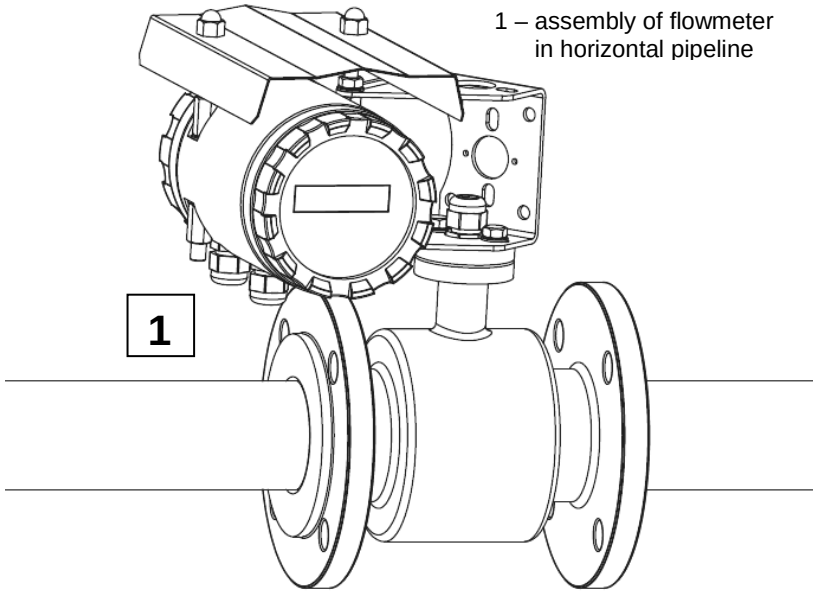
Stainless steel bracket of control unit



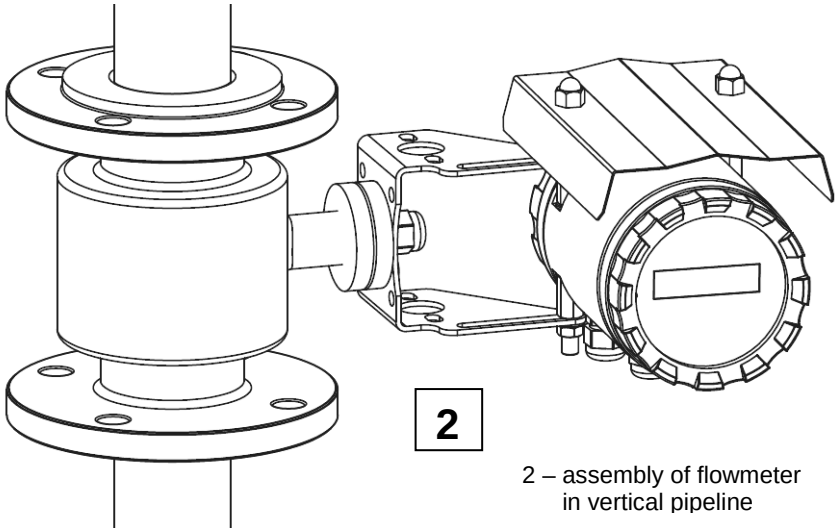
Mounting kit



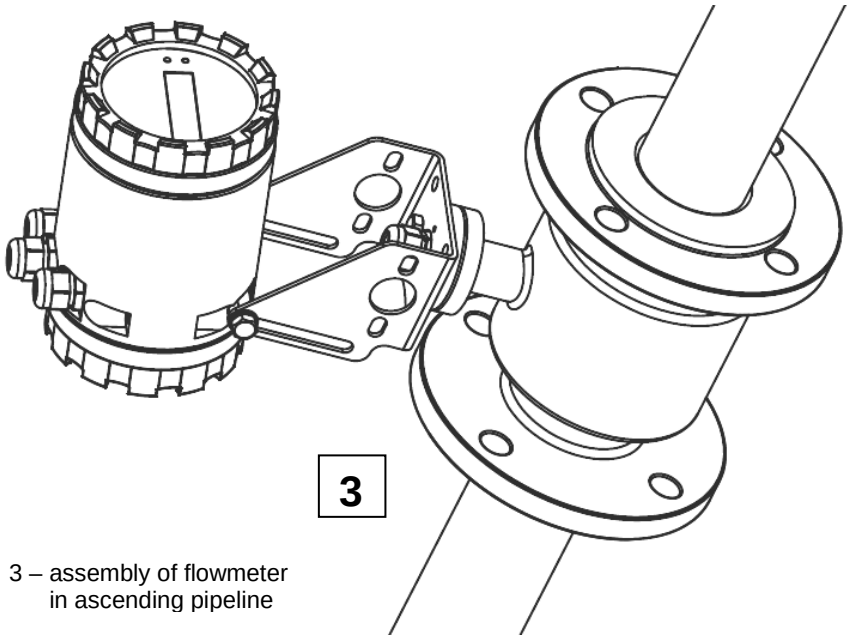
Possibilities of assembly – compact version



1 – assembly of flowmeter
in horizontal pipeline

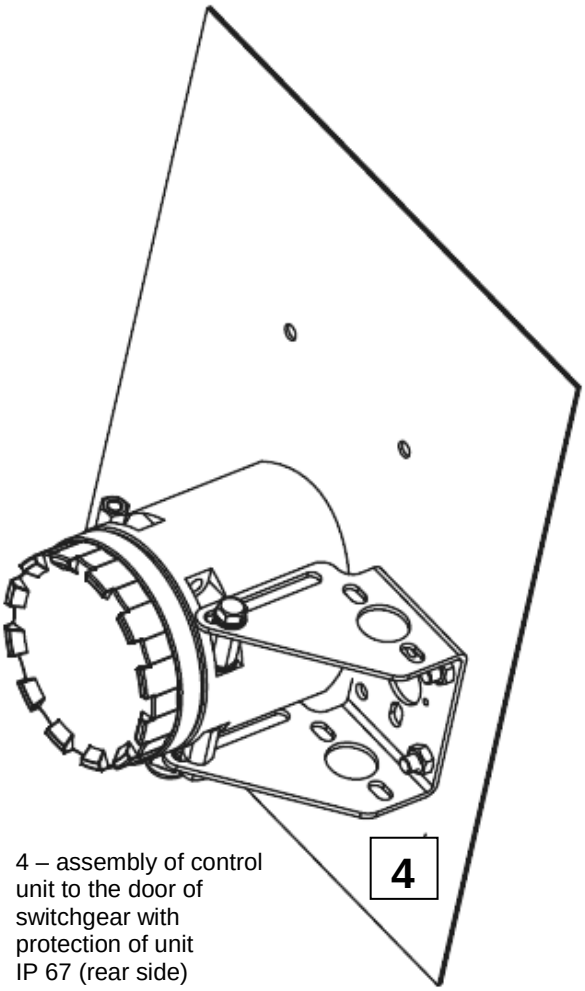


2 – assembly of flowmeter
in vertical pipeline

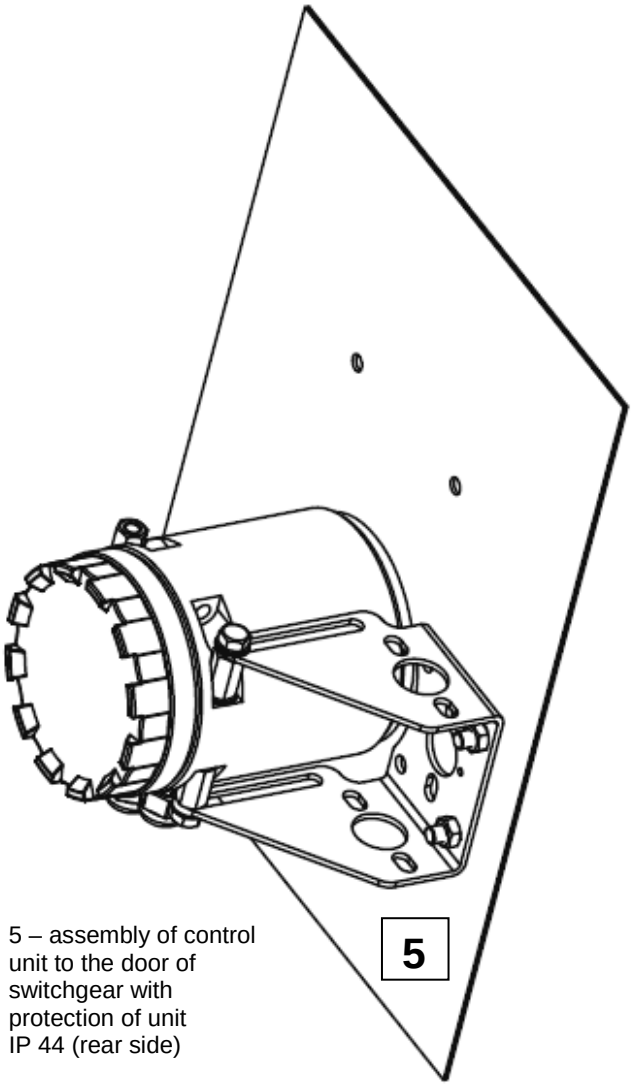


3 – assembly of flowmeter
in ascending pipeline

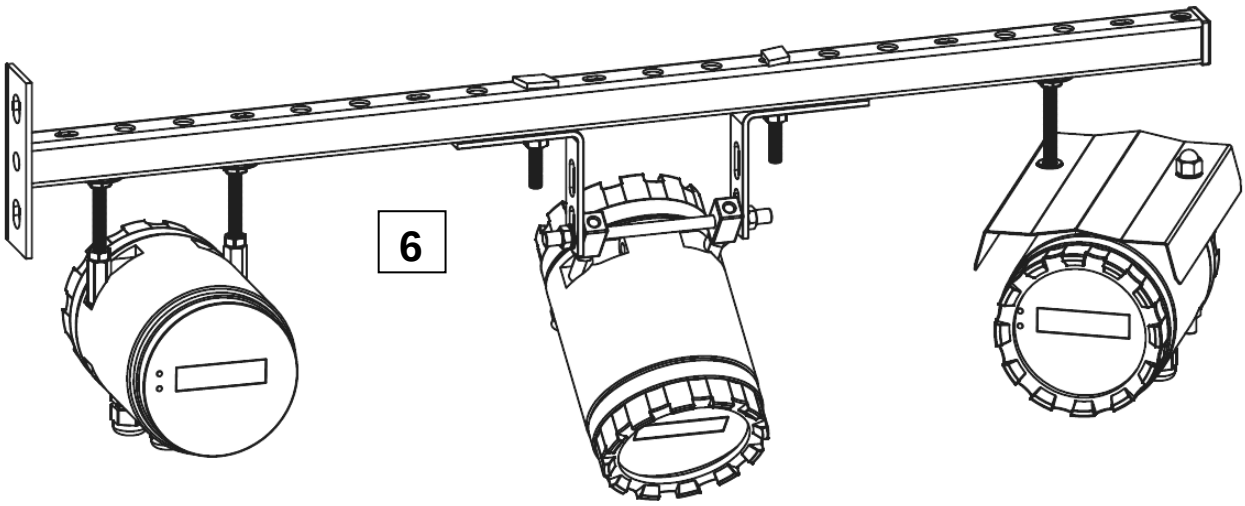
Possibilities of assembly – remote version



4 – assembly of control unit to the door of switchgear with protection of unit IP 67 (rear side)

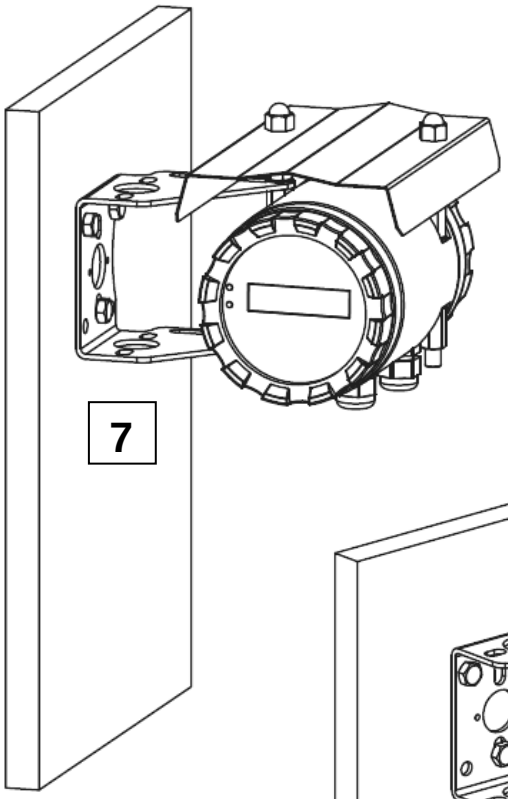


5 – assembly of control unit to the door of switchgear with protection of unit IP 44 (rear side)

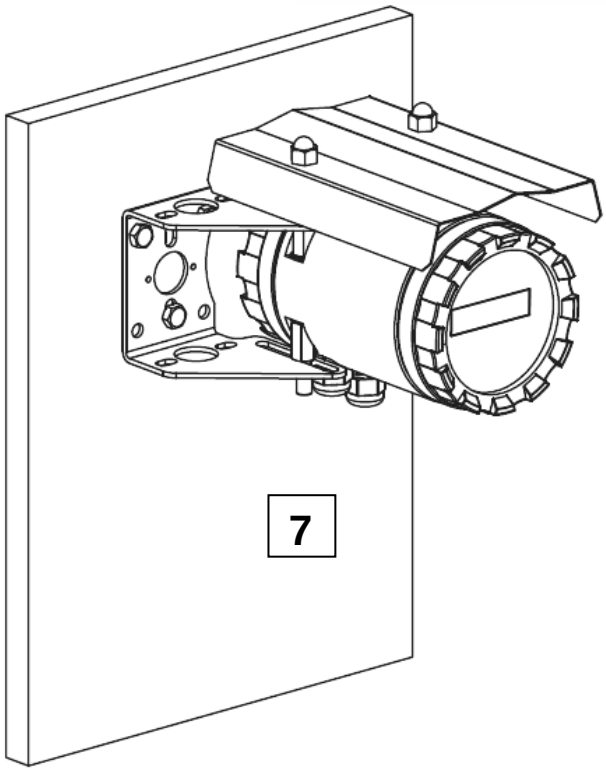


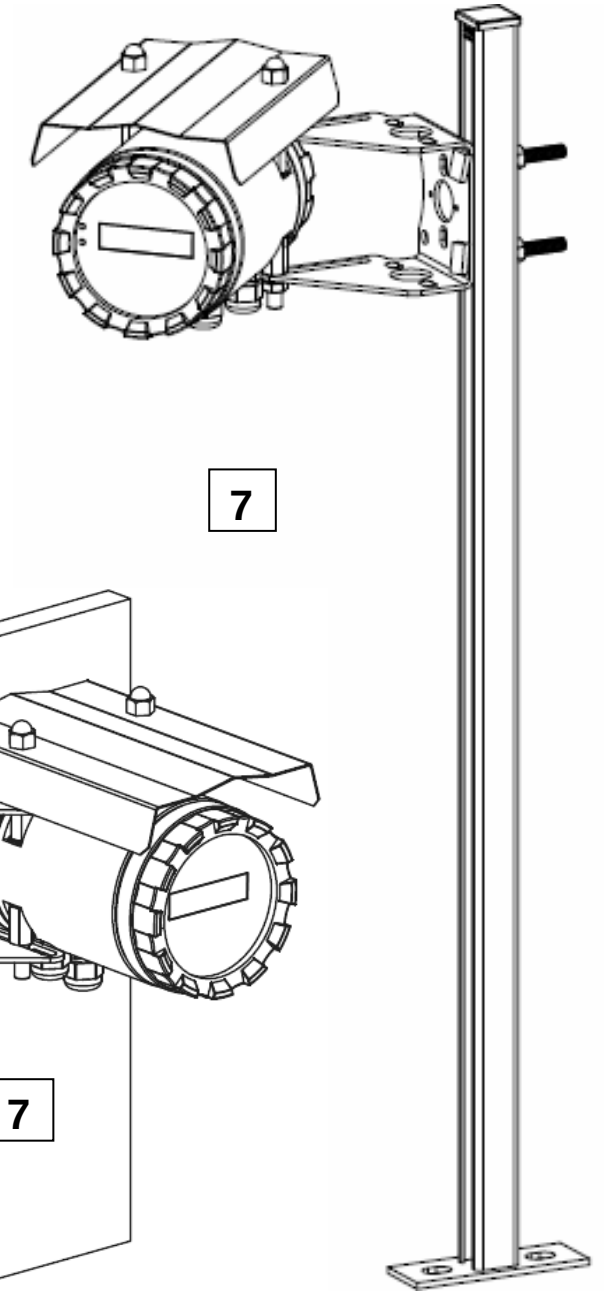
6 – assembly of control unit to the DIN attachment bar or construction of switchgear - multiple overhead and side-by-sice application

Possibilities of assembly

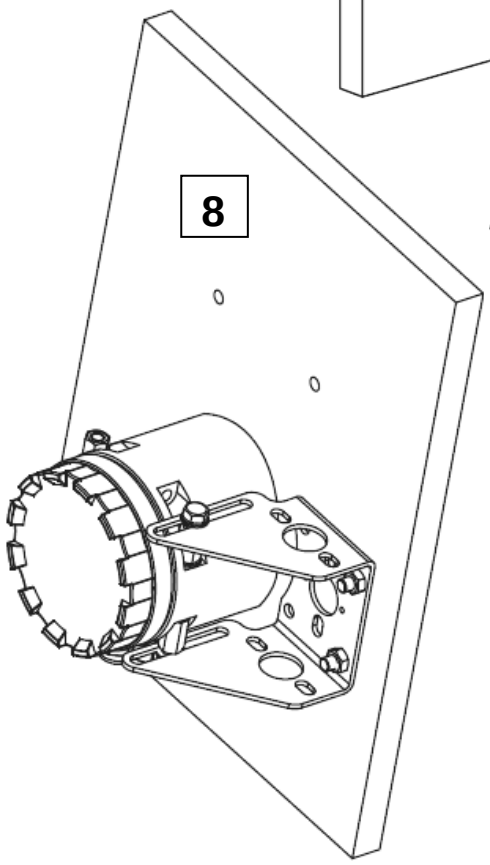


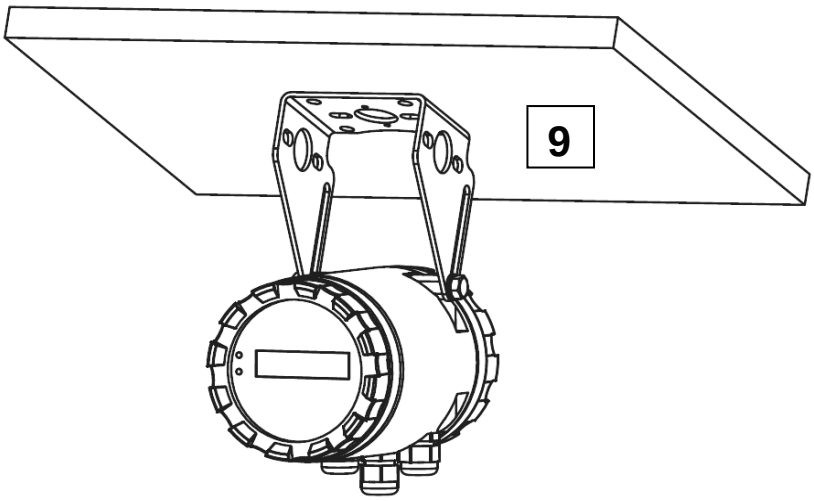
7 – assembly of control unit to the wall - right, left, overhead application and inside unit bracket application





9 – assembly of control unit – overhead application

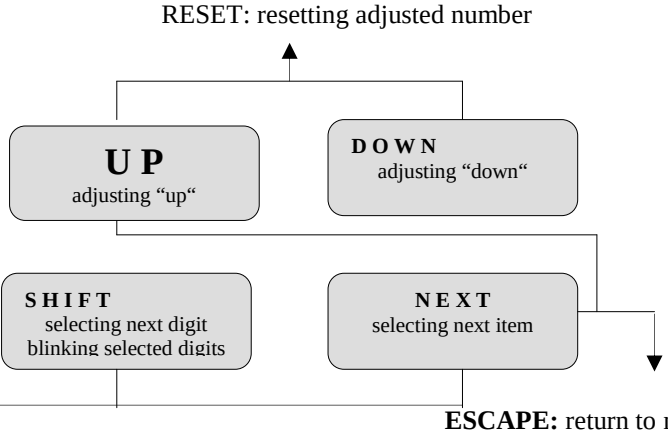




8 – assembly of control unit to the plaster board – back side

Instructions for use:

Keyboard



S + Q menu description– user mode:

S + Q - Displaying current flow in both directions, total volume in both directions, closing a relay. Individual items can be selected in **MAIN** menu, **Display** box.

RUN menu description – measurement mode, reading the statistic data:

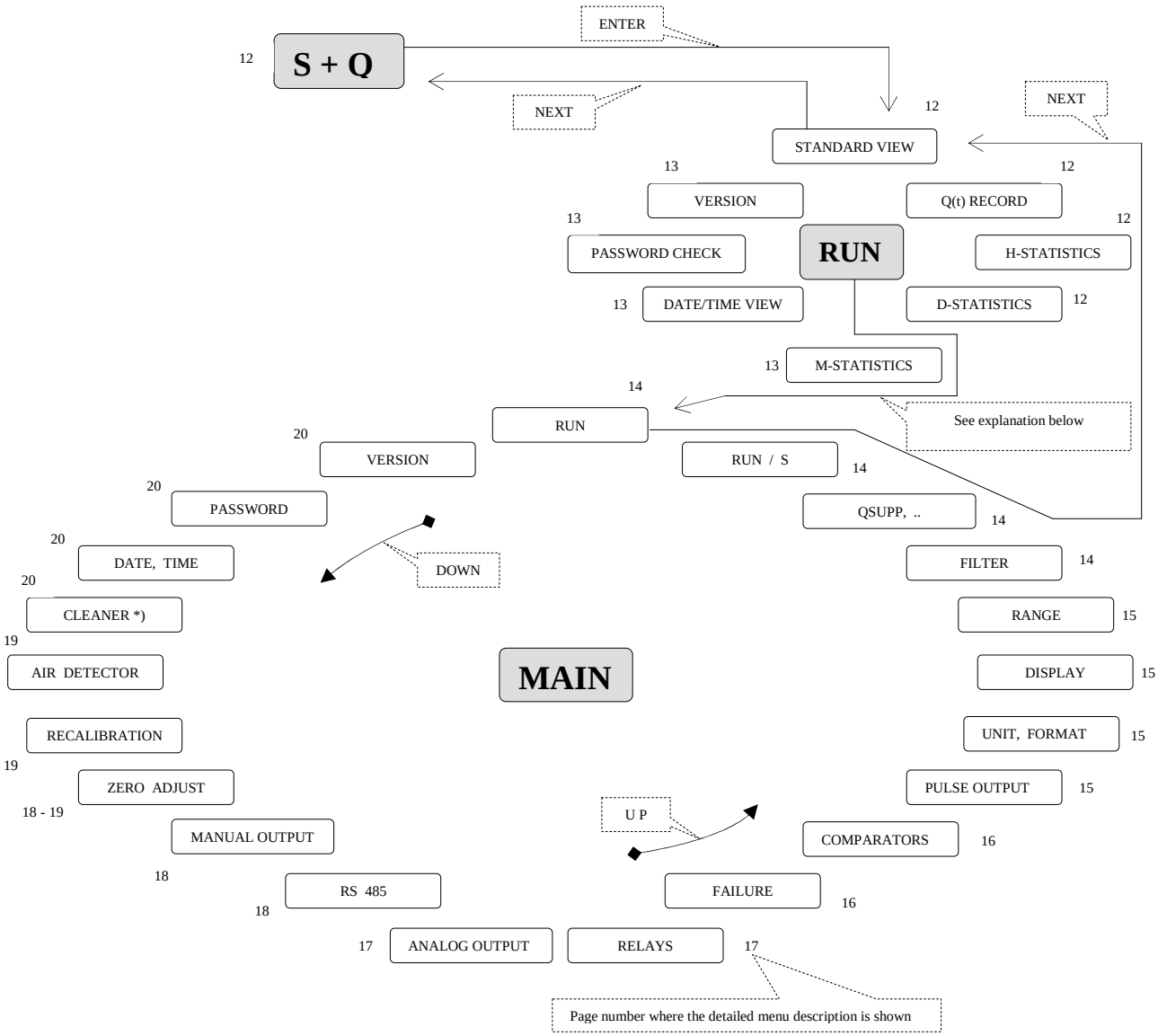
Standard view - Moving from user mode and return.
Q(t) record - Recorded 5-minute average flowrates.
H-statistics - Hourly statistics: total volume, operational time and flowmeter failure time.
D-statistics - Daily statistics: total volume, operational time and flowmeter failure time.
M-statistics - Monthly statistics: total volume, operational time and flowmeter failure time.
Date/time view - Displaying date and time.
Password check - Password check point – see explanations on page 11.
Version - Instrument type and program version.

MAIN menu description – instrument adjustment:

Run - Moving to measurement mode, reading the statistical data and return.
Run / s - Running in service mode (intended for installing and testing the instrument).
Qsupp, .. - low flow rejection limit, identifying positive flow direction, *measurement delay after switching on.*
Filter - *filtration constant and filter delay.*
Range - *current flow range.*
Display - time parameters that display the individual quantities, displaying individual quantities.
Unit, format - flowrate unit Q and format of displaying the quantities Q, S+ and S- .
Pulse output - pulse output for the external counter, total volume per one pulse, pulse width.
Comparators - four flow comparators with 4 modes, static or pulse mode.
Failure - intended for future checking status parameters.
Relays - assigning the functions for relays 1 to 4, external counter pulse output, 1 to 4 comparator outputs, failure, aerating the sensor.
Analog output - assigning output quantity, output range, nominal current (0-20, 4-20, 0-5, 0-10 mA), extending current range above the upper limit of nominal current (e.g. up to 24 mA), negative output range.
RS 485 - entering transmission line parameters
Manual output - manual control (testing) of 1 to 4 relays, current and frequency outputs.
Zero adjust - *adjusting device zero point: performed during calibration in factory, after installation can be completed.*
Recalibration - *adjusting parameters of automatic internal recalibration in the measurement mode.*
Air detector - *adjusting detection parameters of empty piping .*
Cleaner - *cleaner hardware is not present by PEM-1000* thefore cleaner mode must be left off.
Date, time - adjusting the date and time: for initialisation press only NEXT key and hold for 3 seconds.
Password - adjusting the service password, see explanations on page 11
Version - instrument type and program version.

CAUTION: The description in the MAIN, menu written in Italics should not be changed. The parameters are preset with respect to the given location and the sensor type.

Graphic structure of individual – PEM-1000 menus :



*) Cleaner hardware is not present by PEM-1000

Explanations about service password:

1. Service password is defined by following parameters: MAIN \ Password \ Password.
   If Password is set to 0000 (Zero) then password is off and MAIN menu is always ready to open.

2. Password check point is located at: RUN \ Password check \ Password check.

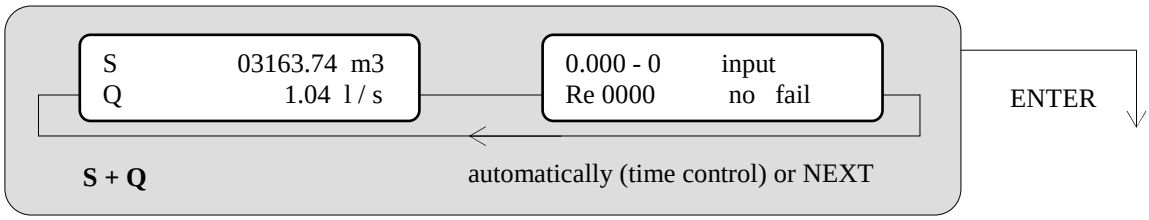
3. Moving from RUN menu to MAIN menu can be done by pressing ENTER anywhere while:
   (Password = 0000) or (Password check = Password)

WARNING:

In order to disable the MAIN menu access after completion of setting process, user must clear (i.e. set to 0000) the Password check item !!

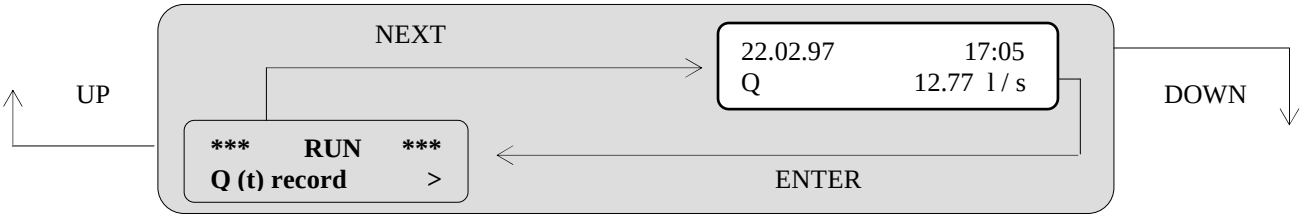
Instructions for use – detailed menu descriptions:

S + Q – user mode:
The program identification and the program version will be displayed during the first three seconds after switching on the instrument. The individual screens of selected quantities will alter (in preset time intervals) automatically after the elapse of a 3-second interval, pressing the NEXT button may also alter the screens. The screens and the intervals may be selected in the **MAIN** menu, and **Display** screen.

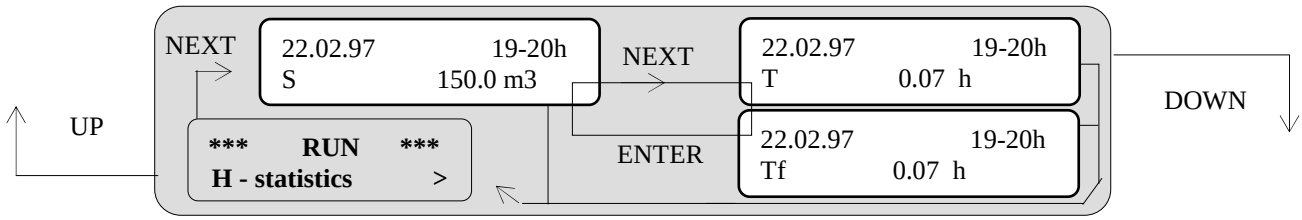


Standard view – moving from the user mode and return: The measurement is proceeding.

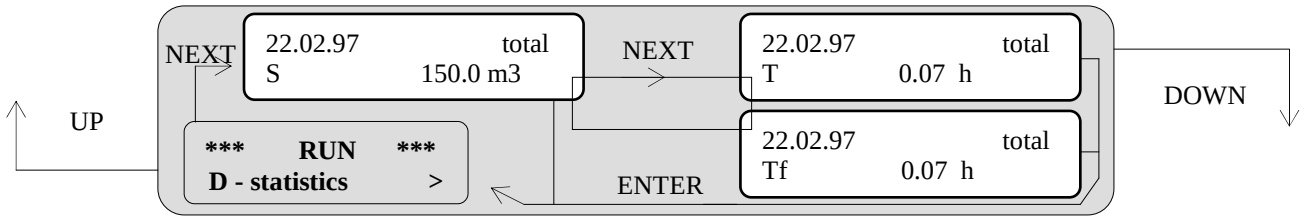
Q (t) record – recording 5-minute average flowrates Q: The measurement is proceeding.
Key functions – UP or DOWN - selection in 5-minute steps, UP+DOWN resets hours and minutes, SHIFT+UP or DOWN - selects the days.



H-statistics – hourly statistics: total volume S, measurement time T and failure time Tf for every hour:
The measurement is proceeding.
Key functions - UP or DOWN, selection in hours, UP+DOWN resets the clock, SHIFT+UP or DOWN selects the days.

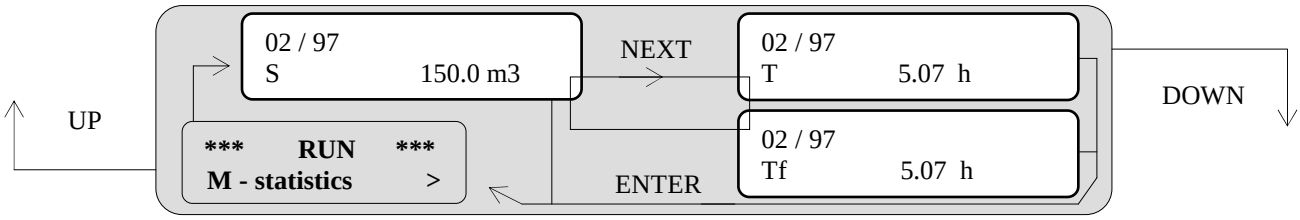


D-statistics – daily statistics: total volume S, measurement time T and failure time Tf for every day:
The measurement is proceeding.
Key functions - UP or DOWN, selection in days, SHIFT+UP or DOWN, selection in months.**D-statistics** - denní statistika:

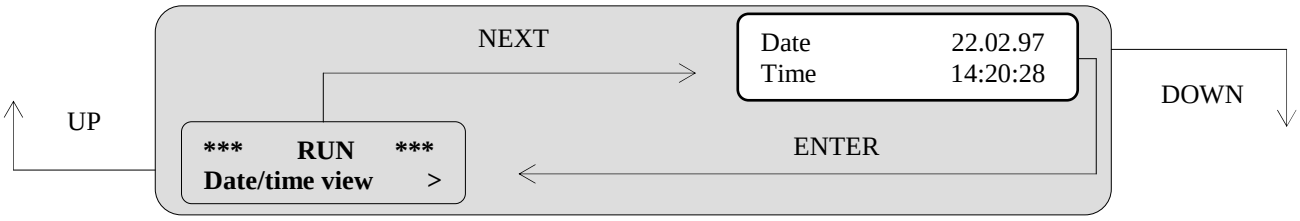


Instructions for use – detailed menu description:

M-statistics – monthly statistics: total volume S, measurement time T and failure interval Tf for every month:
The measurement is proceeding.
Key functions - UP or DOWN selection in months.

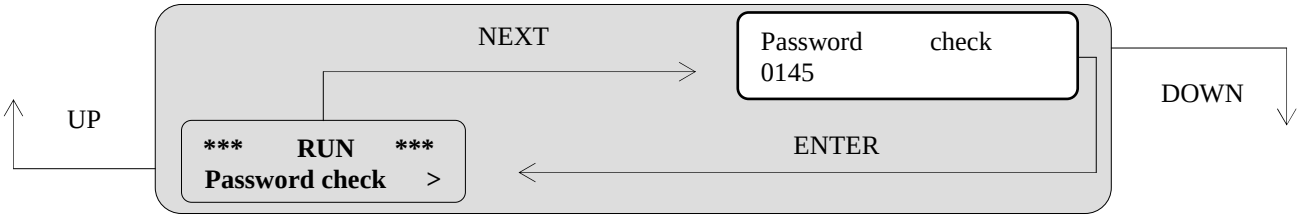


Date/time view – displaying the date and time: The measurement is proceeding.

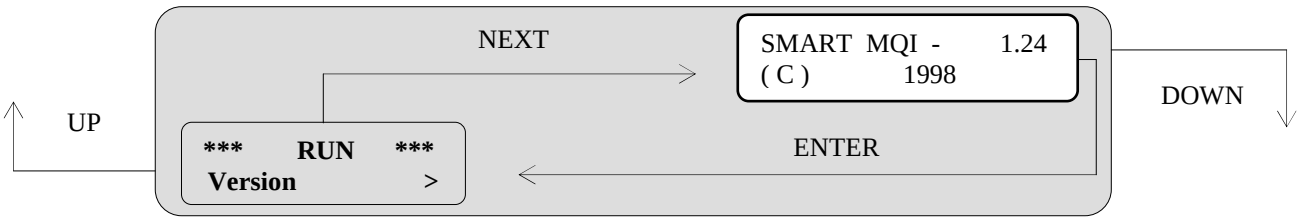


Password check – see explanation on page 16 below.ng.

The password is necessary for moving from RUN to MAIN. The access code for moving in the device menu is set in the factory usually to the value of last three digits of the flowmeter serial number. For example the serial number is 97145 – then the password = **0145**.
Key functions - SHIFT selecting the next digit (selected digits are blinking), UP or DOWN selecting the numbers.



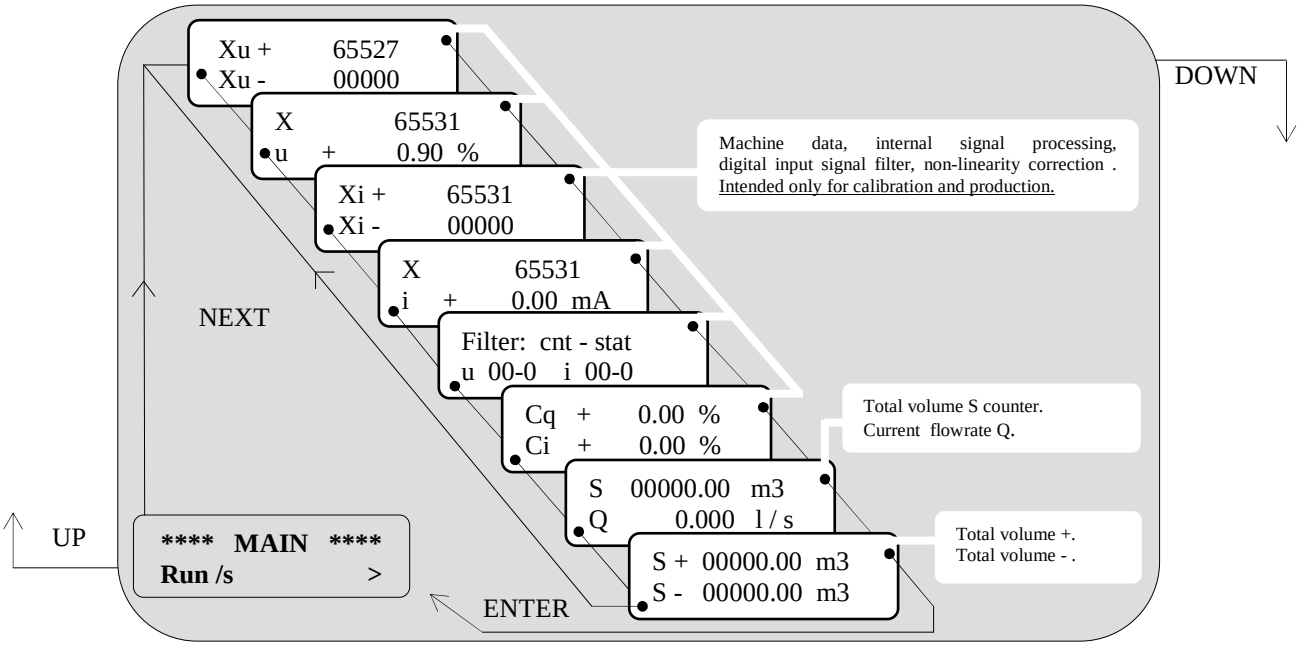
Version – the instrument type and program version: The measurement is proceeding.



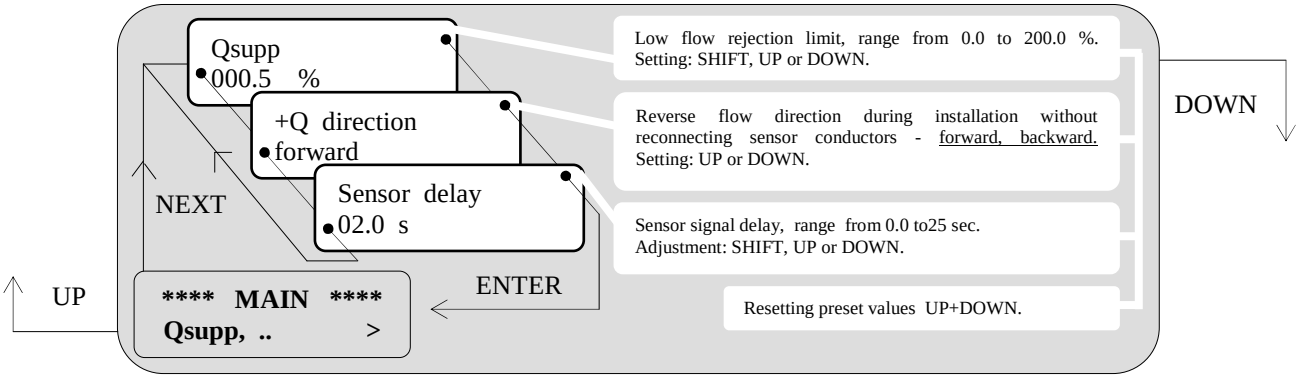
Instructions for adjustment – detailed menu description:

Run – moving to the measurement mode and return:

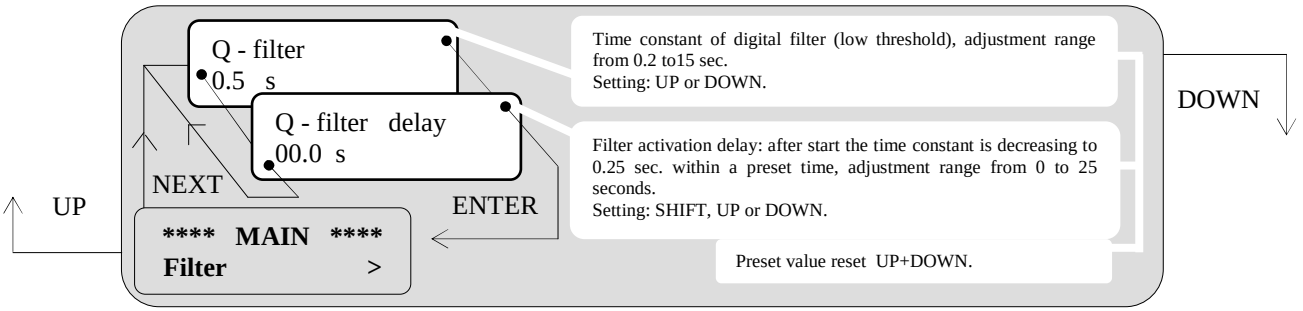
Run /s – the measurement process in the service mode:
This is intended for installing and testing the device. The measurement process is launched in the service mode by pressing the NEXT key. The proper measurement runs in the same way as in the user mode, however the method of displaying the quantities on the screen is modified according to service control. Eight screens can be scrolled on the display by pressing the NEXT key.



Qsupp, .. – low flow rejection limit, identification of positive flow direction, measurement delay after starting the flowmeter:

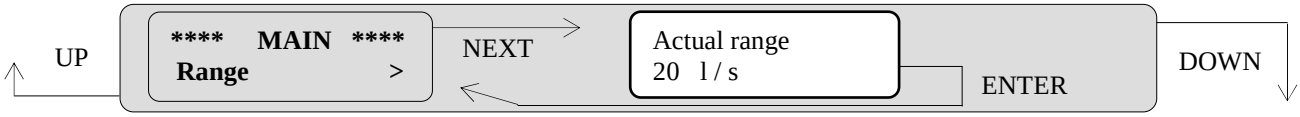

Qsupp
000.5 %
+Q direction
forward
Sensor delay
02.0 s
Low flow rejection limit, range from 0.0 to 200.0 %. Setting: SHIFT, UP or DOWN.
Reverse flow direction during installation without reconnecting sensor conductors - forward, backward. Setting: UP or DOWN.
Sensor signal delay, range from 0.0 to25 sec. Adjustment: SHIFT, UP or DOWN.
Resetting preset values UP+DOWN.
NEXT
UP
**** MAIN ****
Qsupp, .. >
ENTER
DOWN

Filter – these parameters must not be changed without consultation with producer:

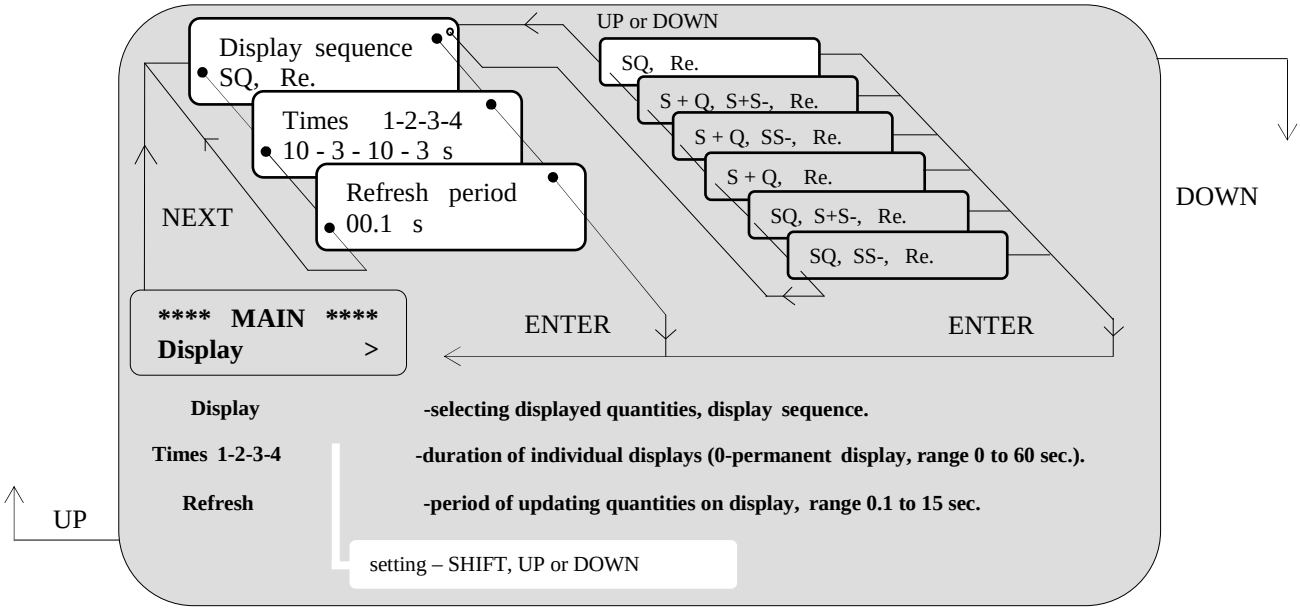

Q - filter
0.5 s
Q - filter delay
00.0 s
Time constant of digital filter (low threshold), adjustment range from 0.2 to15 sec.
Setting: UP or DOWN.
Filter activation delay: after start the time constant is decreasing to 0.25 sec. within a preset time, adjustment range from 0 to 25 seconds.
Setting: SHIFT, UP or DOWN.
Preset value reset UP+DOWN.
NEXT
UP
**** MAIN ****
Filter >
ENTER
DOWN

Instructions for adjustment - detailed menu description:

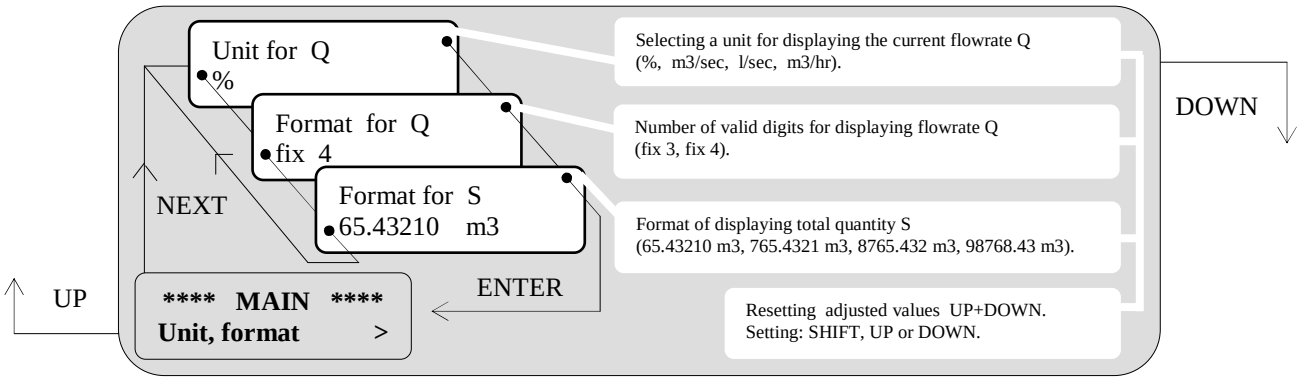
Range – current flowrate range: *however the instrument operates up to 200 percent of this value!*
Must be not changed without consultation with producer !



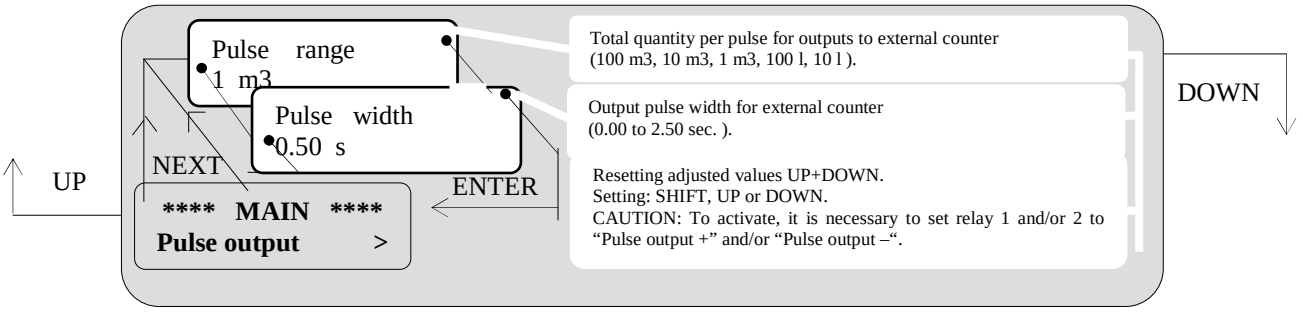
Display – time parameters displaying individual quantities, format of displaying individual quantities:



Unit, format – flowrate unit Q and format of displaying quantities Q, S+ and S-:

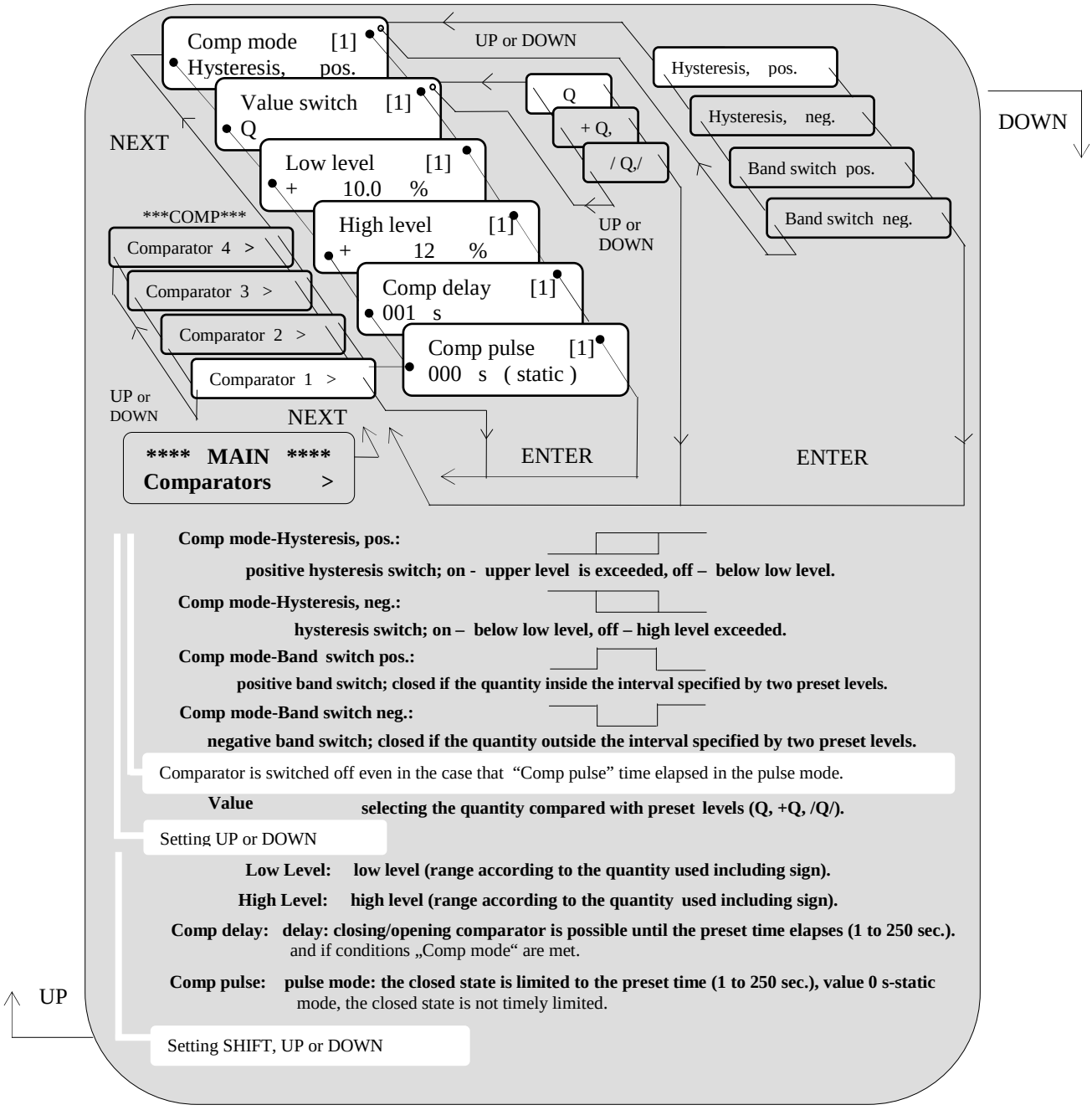


Pulse output – pulse output for external counter, total quantity per 1 pulse, pulse width.


Pulse range
1 m3
Pulse width
0.50 s
NEXT
**** MAIN ****
Pulse output >
ENTER
Total quantity per pulse for outputs to external counter
(100 m3, 10 m3, 1 m3, 100 l, 10 l).
Output pulse width for external counter
(0.00 to 2.50 sec.).
Resetting adjusted values UP+DOWN.
Setting: SHIFT, UP or DOWN.
CAUTION: To activate, it is necessary to set relay 1 and/or 2 to
"Pulse output +" and/or "Pulse output –".
DOWN
UP

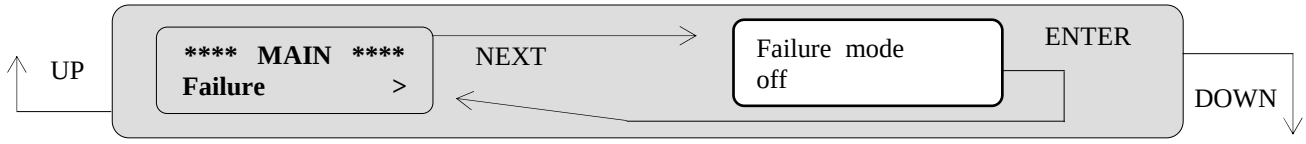
Instructions for adjustment - detailed menu description:

Comparators – four flow comparators with 4 modes, static and/or pulse modes are available:


Comp mode [1]
Hysteresis, pos.
Value switch [1]
Q
Low level [1]
+ 10.0 %
High level [1]
+ 12 %
Comp delay [1]
001 s
Comp pulse [1]
000 s (static)
UP or DOWN
Q
+ Q,
/ Q,/
Hysteresis, pos.
Hysteresis, neg.
Band switch pos.
Band switch neg.
DOWN
NEXT
COMP
Comparator 4 >
Comparator 3 >
Comparator 2 >
Comparator 1 >
UP or DOWN
UP or DOWN
NEXT
**** MAIN ****
Comparators >
ENTER
ENTER
Comp mode-Hysteresis, pos.:
positive hysteresis switch; on - upper level is exceeded, off – below low level.
Comp mode-Hysteresis, neg.:
hysteresis switch; on – below low level, off – high level exceeded.
Comp mode-Band switch pos.:
positive band switch; closed if the quantity inside the interval specified by two preset levels.
Comp mode-Band switch neg.:
negative band switch; closed if the quantity outside the interval specified by two preset levels.
Comparator is switched off even in the case that "Comp pulse" time elapsed in the pulse mode.
Value
selecting the quantity compared with preset levels (Q, +Q, /Q/).
Setting UP or DOWN
Low Level: low level (range according to the quantity used including sign).
High Level: high level (range according to the quantity used including sign).
Comp delay: delay: closing/opening comparator is possible until the preset time elapses (1 to 250 sec.).
and if conditions „Comp mode" are met.
Comp pulse: pulse mode: the closed state is limited to the preset time (1 to 250 sec.), value 0 s-static
mode, the closed state is not timely limited.
UP
Setting SHIFT, UP or DOWN

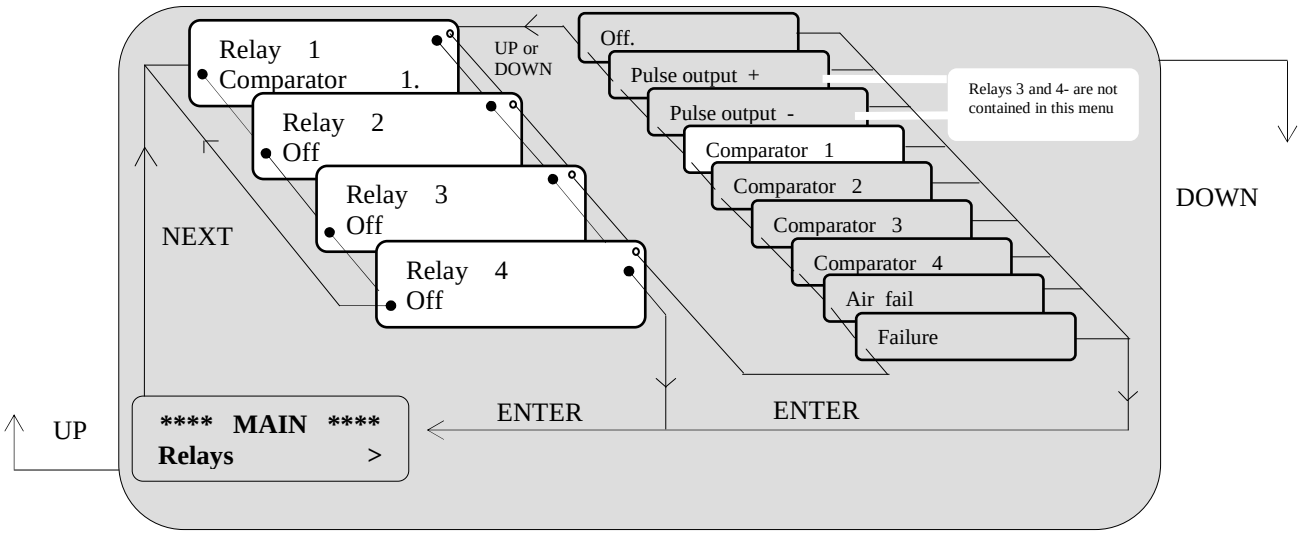
CAUTION: In addition to setting the quantities in compliance with the above-mentioned table, it is necessary to select a relay in „Comparators 1 to 4" mode. Otherwise the comparator has no effect on PEM-1000 outputs.

Failure – intended for a future parameter extension that will control the status:

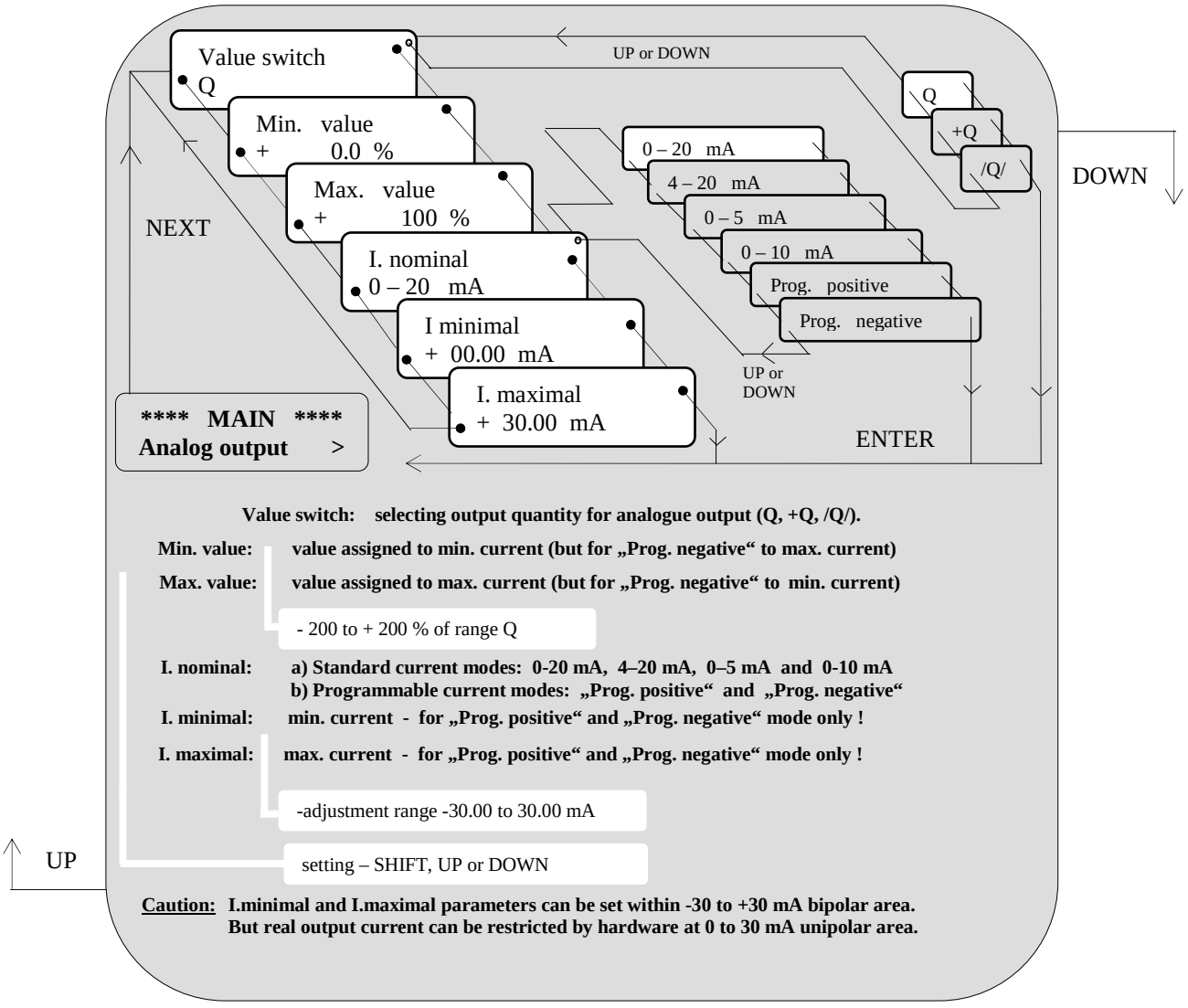


Instructions for adjustment – detailed menu description:

Relays – assigning the functions for relay 1 to 4, pulse output for external counter, 1 to 4 comparator output, sensor failure and sensor aeration:

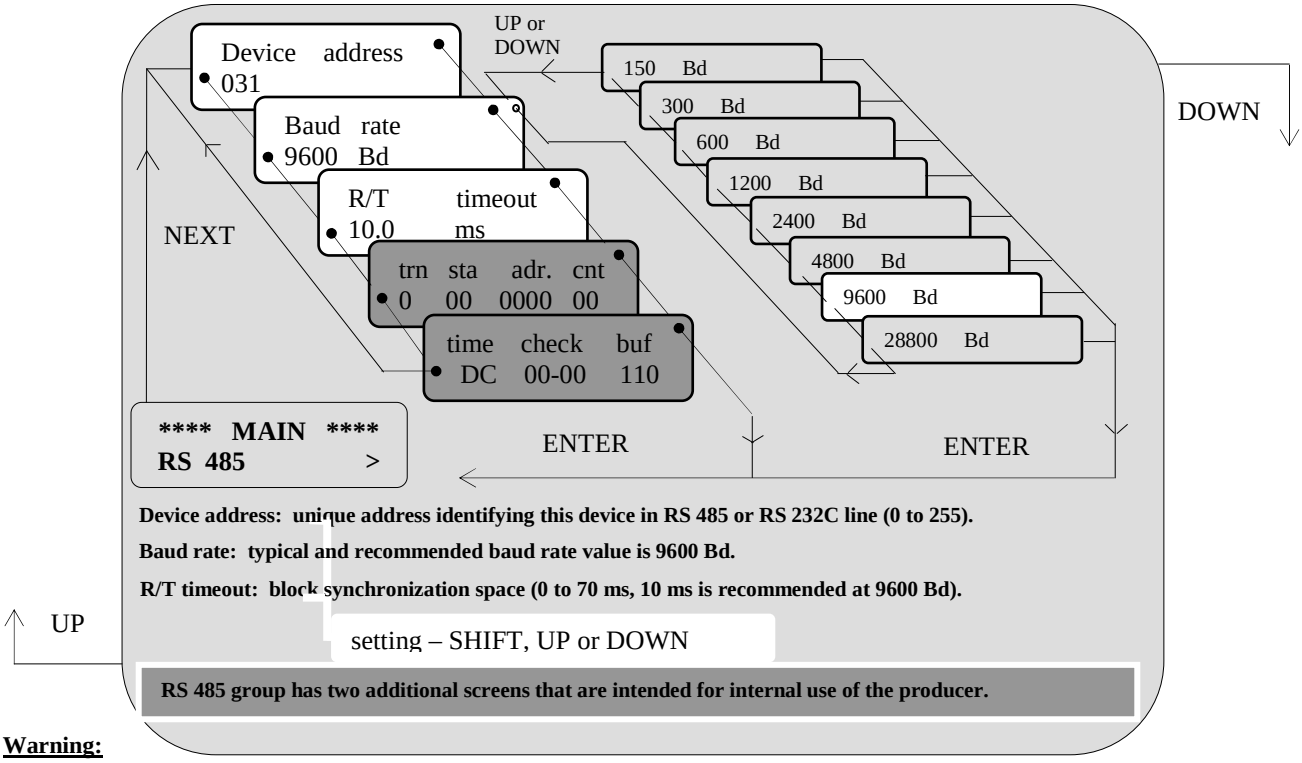


Analog output – assigning output quantity, output range, nominal current, current range extension:


Value switch
Q
Min. value
+ 0.0 %
Max. value
+ 100 %
I. nominal
0 – 20 mA
I minimal
+ 00.00 mA
I. maximal
+ 30.00 mA
UP or DOWN
Q
+Q
/Q/
0 – 20 mA
4 – 20 mA
0 – 5 mA
0 – 10 mA
Prog. positive
Prog. negative
UP or DOWN
NEXT
DOWN
**** MAIN ****
Analog output >
ENTER
Value switch: selecting output quantity for analogue output (Q, +Q, /Q/).
Min. value: value assigned to min. current (but for „Prog. negative“ to max. current)
Max. value: value assigned to max. current (but for „Prog. negative“ to min. current)
- 200 to + 200 % of range Q
I. nominal: a) Standard current modes: 0-20 mA, 4–20 mA, 0–5 mA and 0-10 mA
b) Programmable current modes: „Prog. positive“ and „Prog. negative“
I. minimal: min. current - for „Prog. positive“ and „Prog. negative“ mode only !
I. maximal: max. current - for „Prog. positive“ and „Prog. negative“ mode only !
-adjustment range -30.00 to 30.00 mA
UP
setting – SHIFT, UP or DOWN
Caution: I.minimal and I.maximal parameters can be set within -30 to +30 mA bipolar area.
But real output current can be restricted by hardware at 0 to 30 mA unipolar area.

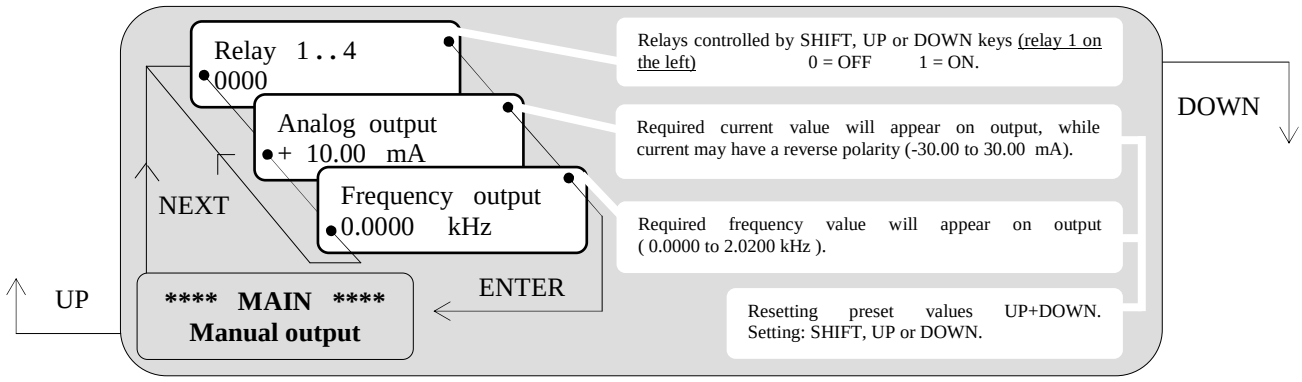
Instructions for adjustment - detailed menu description:

RS 485 – parameters for RS 485 or RS 232C communication port:
Device communication port serves for transfer of basic device quantities (Q, S, S+, S-, status informations) and all statistics memory contents. It uses special factory communication protocol described in programmers manual



Warning:
In order to ensure correct function of communication and data acquisition process, any device inside network or database group must have unique Device address. It is necessary for any line standard (RS 485, RS 232C or other).

Manual output – manual control (testing) of 1 to 4 relays, and current and frequency output:


Relay 1..4
0000
Analog output
+ 10.00 mA
Frequency output
0.0000 kHz
Relays controlled by SHIFT, UP or DOWN keys (relay 1 on the left) 0 = OFF 1 = ON.
Required current value will appear on output, while current may have a reverse polarity (-30.00 to 30.00 mA).
Required frequency value will appear on output (0.0000 to 2.0200 kHz).
Resetting preset values UP+DOWN.
Setting: SHIFT, UP or DOWN.
DOWN
NEXT
UP
**** MAIN ****
Manual output
ENTER

Caution: **Manually set (requested) output current value is within -30 to +30 mA bipolar area.**
But real output current can be restricted by hardware at 0 to 30 mA unipolar area.

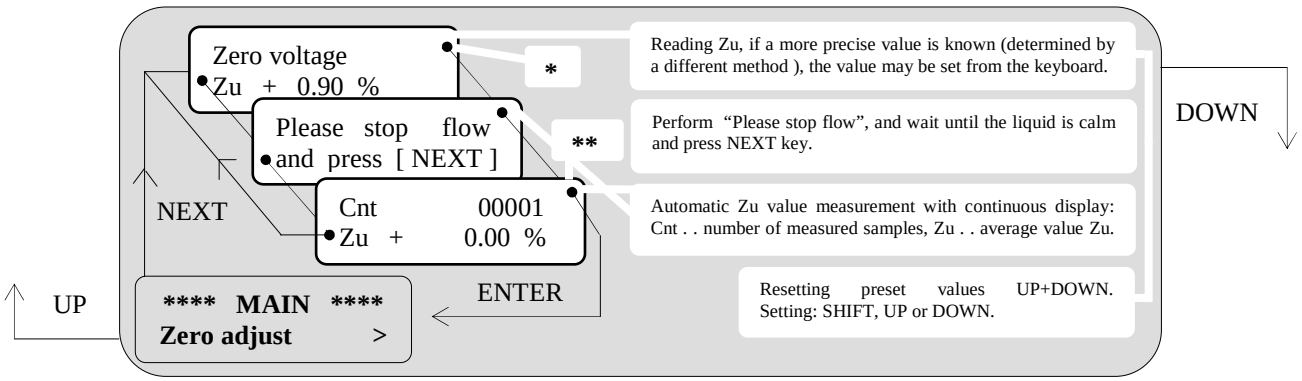
Zero adjust – setting the zero point of the device, performed during calibration in factory, any readjustment during installation is possible:

Consult the manufacturer if you want to change zero adjust. The adjustment is given by the quantity value Zu [%] that can be measured or set from the keyboard.

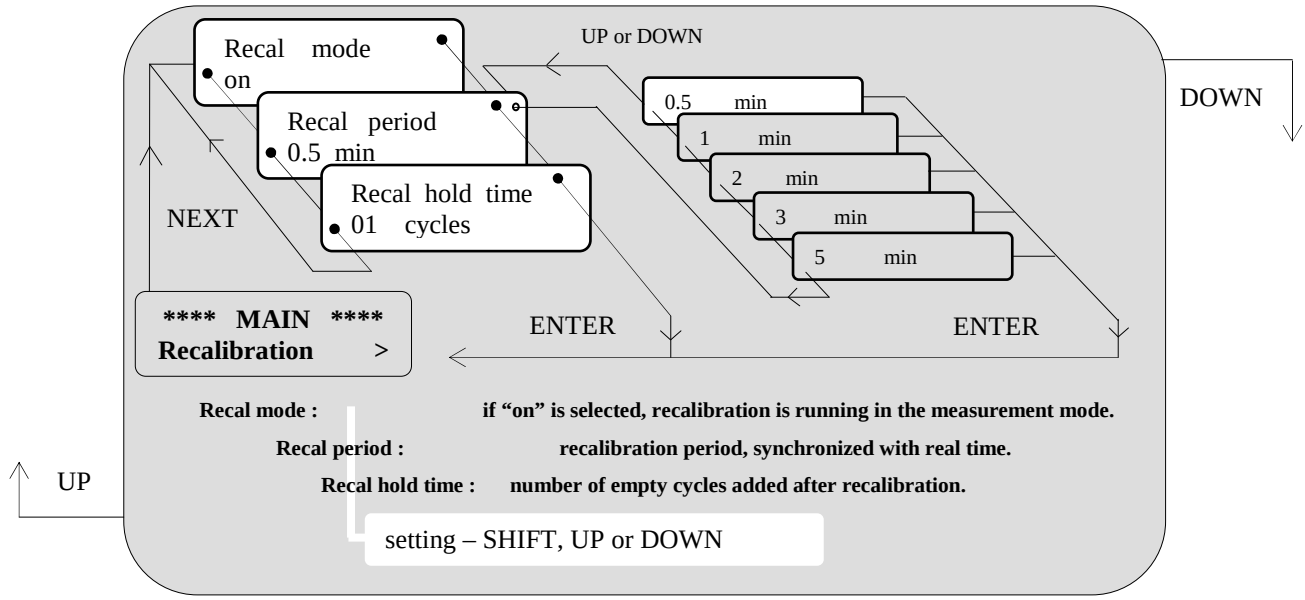
Legend to the following graphics:

*** Press NEXT key in the case that the Zu value should be measured, otherwise use ENTER or ESCAPE to return to menu.**

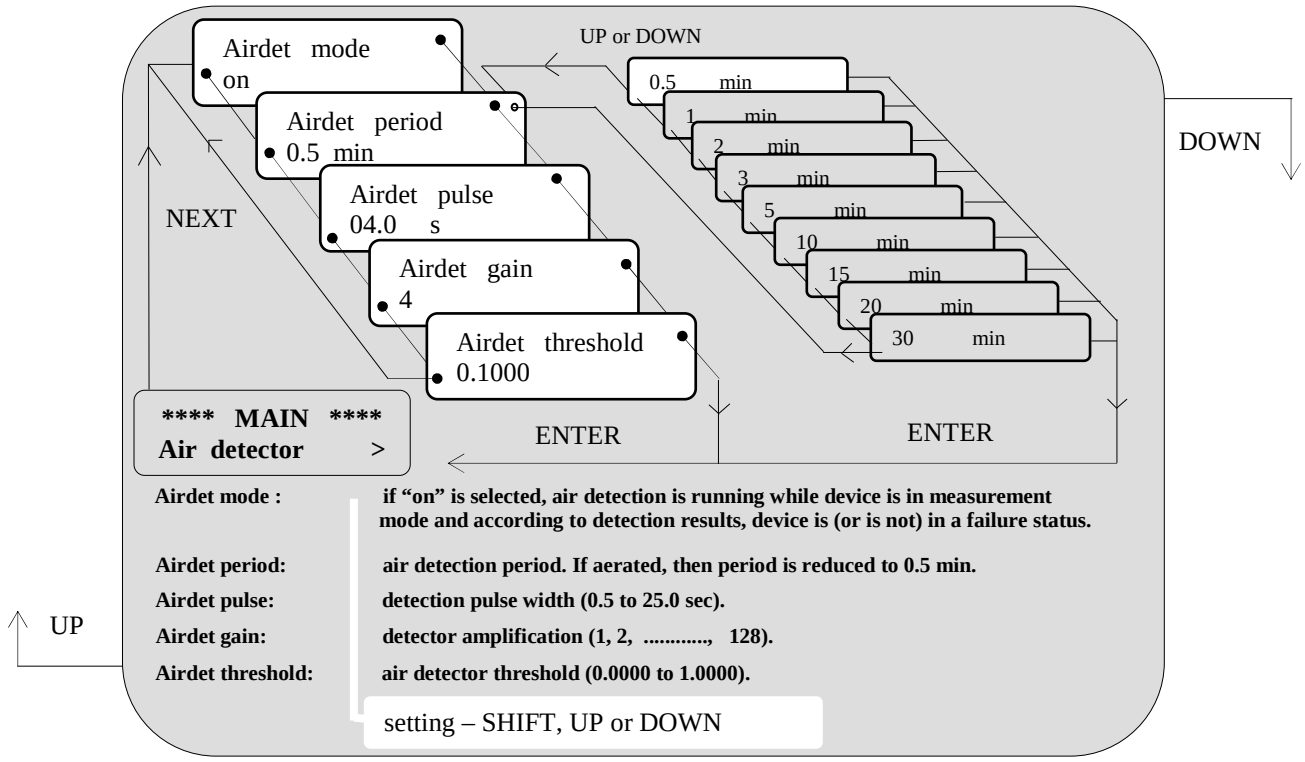
**** The measurement is completed automatically when the preset number of samples (limit) has been measured (this number of samples is optimised in the factory). Only in an emergency, should pressing NEXT or ESCAPE key from the keyboard be used to interrupt the measurement.**


Zero voltage
Zu + 0.90 %
*
Reading Zu, if a more precise value is known (determined by a different method), the value may be set from the keyboard.
Please stop flow
and press [NEXT]
**
Perform "Please stop flow", and wait until the liquid is calm and press NEXT key.
Cnt 00001
Zu + 0.00 %
Automatic Zu value measurement with continuous display: Cnt . . number of measured samples, Zu . . average value Zu.
DOWN
NEXT
UP
**** MAIN ****
Zero adjust >
ENTER
Resetting preset values UP+DOWN.
Setting: SHIFT, UP or DOWN.

Recalibration – consult the manufacturer if you want to change these setings.

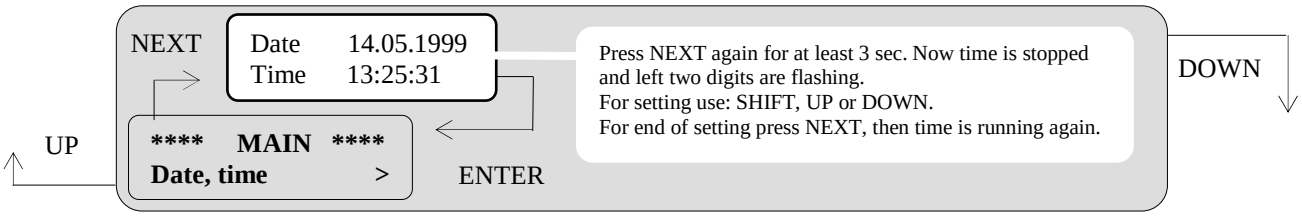


Air detector – consult the manufacturer if you want to change these setings.

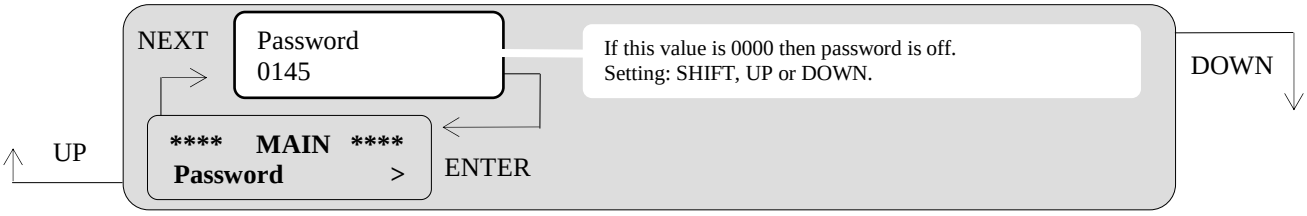


Cleaner – cleaner hardware is not present at PEM-1000.
Therefore cleaner mode must be left off.

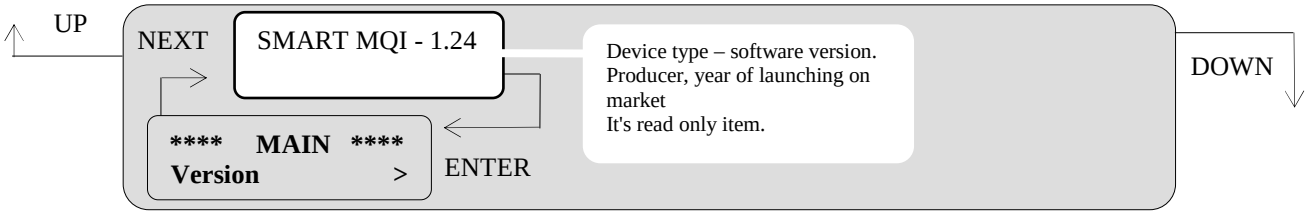
Date, time – setting the date and time, for initialisation press NEXT key and hold for 3 sec.:


NEXT
Date 14.05.1999
Time 13:25:31
**** MAIN ****
Date, time >
ENTER
UP
DOWN
Press NEXT again for at least 3 sec. Now time is stopped and left two digits are flashing.
For setting use: SHIFT, UP or DOWN.
For end of setting press NEXT, then time is running again.

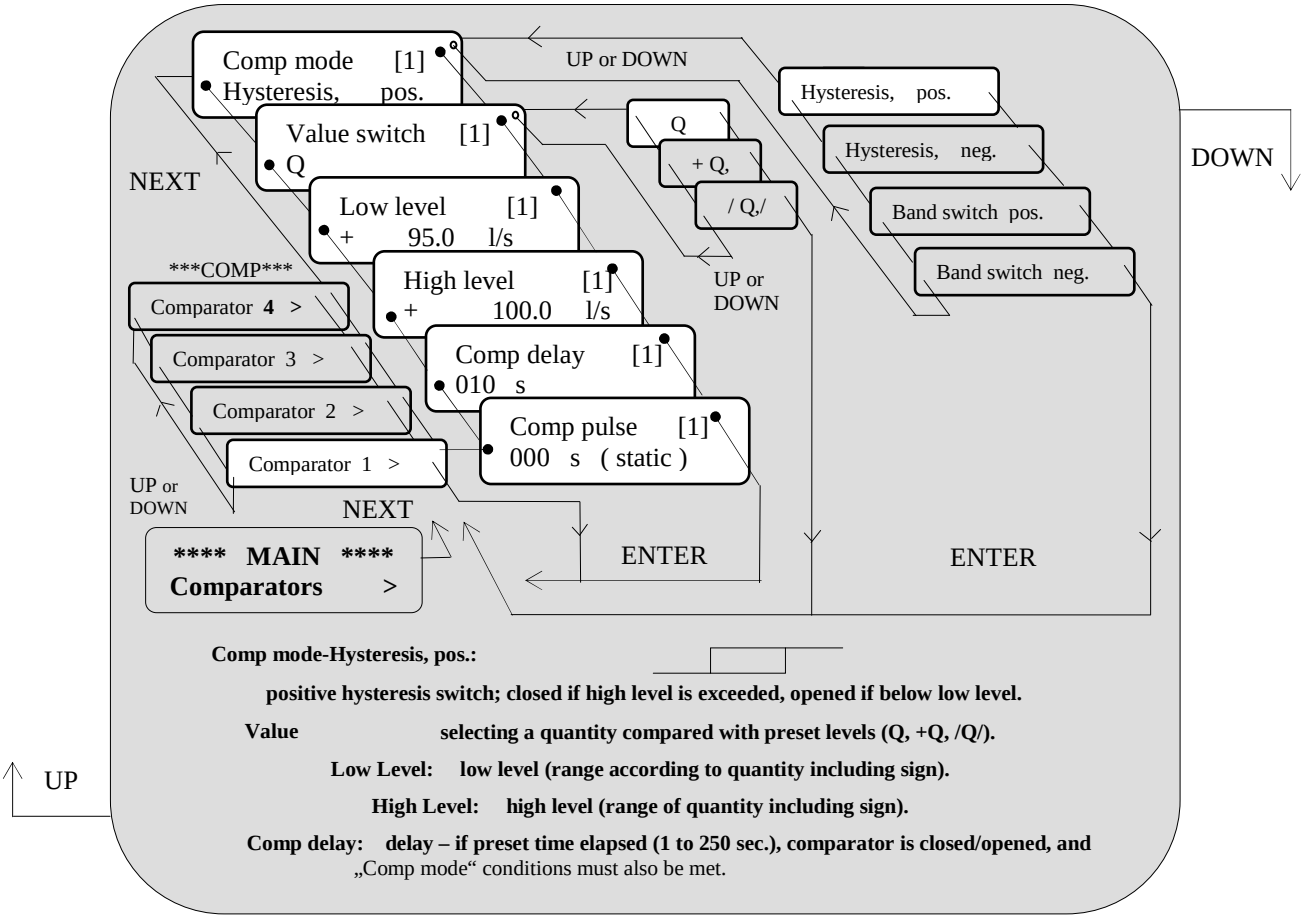
Password - setting the service password (see explanation on page 11 below)



Version – device type and program version:

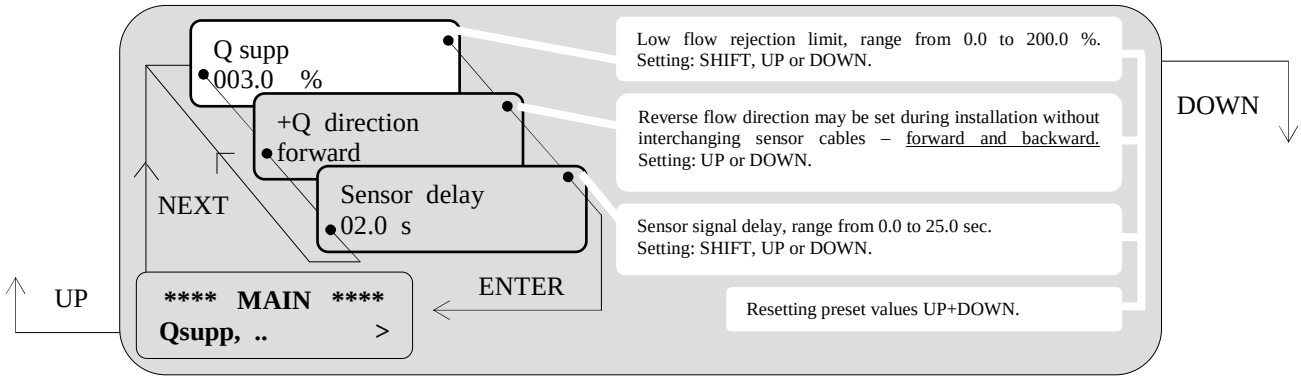


Example:
If flow is higher than 100 l/sec., it is necessary to close a relay contact in the PEM-1000 unit. Adjust the following parameters:



Relay 1 – for Comparator 1 must also be assigned in the **Relays** menu to the preset comparator. The preset comparator including the assigned relay will close/open relay 1 if current flowrate exceeds 100 l/sec. with a preset delay of 10 sec. The closed relay 1 will open if flowrate reduces below 95 l/sec. with a delay 10 sec.

Example:
The flowrates below the low limit of up to 3 percent of the range must be blocked (i.e. sneak flowrate). Adjust the following parameters:



The preset low limit will prevent to measure in a range lower than 3 percent for a flowmeter (including the counter integration).
All other corrections and adjustment of PEM-1000 device may be carried out similarly according to the instructions for adjustment.